Nokia Customer Care

Service Manual

RM-164 (Nokia 8600)

Mobile Terminal

Part No: 9203796 (Issue 1)

COMPANY CONFIDENTIAL

Amendment Record Sheet

Amendment No	Date	Inserted By	Comments
Issue 1	05/2007	MHa	

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IMPORTANT

This document is intended for use by qualified service personnel only.

Warnings and cautions

Warnings

- IF THE DEVICE CAN BE INSTALLED IN A VEHICLE, CARE MUST BE TAKEN ON INSTALLATION IN VEHICLES FITTED WITH ELECTRONIC ENGINE MANAGEMENT SYSTEMS AND ANTI-SKID BRAKING SYSTEMS. UNDER CERTAIN FAULT CONDITIONS, EMITTED RF ENERGY CAN AFFECT THEIR OPERATION. IF NECESSARY, CONSULT THE VEHICLE DEALER/ MANUFACTURER TO DETERMINE THE IMMUNITY OF VEHICLE ELECTRONIC SYSTEMS TO RF ENERGY.
- THE PRODUCT MUST NOT BE OPERATED IN AREAS LIKELY TO CONTAIN POTENTIALLY EXPLOSIVE ATMOSPHERES, FOR EXAMPLE, PETROL STATIONS (SERVICE STATIONS), BLASTING AREAS ETC.
- OPERATION OF ANY RADIO TRANSMITTING EQUIPMENT, INCLUDING CELLULAR TELEPHONES, MAY INTERFERE WITH THE FUNCTIONALITY OF INADEQUATELY PROTECTED MEDICAL DEVICES. CONSULT A PHYSICIAN OR THE MANUFACTURER OF THE MEDICAL DEVICE IF YOU HAVE ANY QUESTIONS. OTHER ELECTRONIC EQUIPMENT MAY ALSO BE SUBJECT TO INTERFERENCE.
- BEFORE MAKING ANY TEST CONNECTIONS, MAKE SURE YOU HAVE SWITCHED OFF ALL EQUIPMENT.

Cautions

- Servicing and alignment must be undertaken by qualified personnel only.
- Ensure all work is carried out at an anti-static workstation and that an anti-static wrist strap is worn.
- Ensure solder, wire, or foreign matter does not enter the telephone as damage may result.
- Use only approved components as specified in the parts list.
- Ensure all components, modules, screws and insulators are correctly re-fitted after servicing and alignment.
- Ensure all cables and wires are repositioned correctly.
- Never test a mobile phone WCDMA transmitter with full Tx power, if there is no possibility to perform the measurements in a good performance RF-shielded room. Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.
- During testing never activate the GSM or WCDMA transmitter without a proper antenna load, otherwise GSM or WCDMA PA may be damaged.

For your safety

QUALIFIED SERVICE

Only qualified personnel may install or repair phone equipment.

ACCESSORIES AND BATTERIES

Use only approved accessories and batteries. Do not connect incompatible products.

CONNECTING TO OTHER DEVICES

When connecting to any other device, read its user's guide for detailed safety instructions. Do not connect incompatible products.

Care and maintenance

This product is of superior design and craftsmanship and should be treated with care. The suggestions below will help you to fulfil any warranty obligations and to enjoy this product for many years.

- Keep the phone and all its parts and accessories out of the reach of small children.
- Keep the phone dry. Precipitation, humidity and all types of liquids or moisture can contain minerals that will corrode electronic circuits.
- Do not use or store the phone in dusty, dirty areas. Its moving parts can be damaged.
- Do not store the phone in hot areas. High temperatures can shorten the life of electronic devices, damage batteries, and warp or melt certain plastics.
- Do not store the phone in cold areas. When it warms up (to its normal temperature), moisture can form inside, which may damage electronic circuit boards.
- Do not drop, knock or shake the phone. Rough handling can break internal circuit boards.
- Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the phone.
- Do not paint the phone. Paint can clog the moving parts and prevent proper operation.
- Use only the supplied or an approved replacement antenna. Unauthorised antennas, modifications or attachments could damage the phone and may violate regulations governing radio devices.

All of the above suggestions apply equally to the product, battery, charger or any accessory.

ESD protection

Nokia requires that service points have sufficient ESD protection (against static electricity) when servicing the phone.

Any product of which the covers are removed must be handled with ESD protection. The SIM card can be replaced without ESD protection if the product is otherwise ready for use.

To replace the covers ESD protection must be applied.

All electronic parts of the product are susceptible to ESD. Resistors, too, can be damaged by static electricity discharge.

All ESD sensitive parts must be packed in metallized protective bags during shipping and handling outside any ESD Protected Area (EPA).

Every repair action involving opening the product or handling the product components must be done under ESD protection.

ESD protected spare part packages MUST NOT be opened/closed out of an ESD Protected Area.

For more information and local requirements about ESD protection and ESD Protected Area, contact your local Nokia After Market Services representative.

Battery information

Note: A new battery's full performance is achieved only after two or three complete charge and discharge cycles!

The battery can be charged and discharged hundreds of times but it will eventually wear out. When the operating time (talk-time and standby time) is noticeably shorter than normal, it is time to buy a new battery.

Use only batteries approved by the phone manufacturer and recharge the battery only with the chargers approved by the manufacturer. Unplug the charger when not in use. Do not leave the battery connected to a charger for longer than a week, since overcharging may shorten its lifetime. If left unused a fully charged battery will discharge itself over time.

Temperature extremes can affect the ability of your battery to charge.

For good operation times with Ni-Cd/NiMh batteries, discharge the battery from time to time by leaving the product switched on until it turns itself off (or by using the battery discharge facility of any approved accessory available for the product). Do not attempt to discharge the battery by any other means.

Use the battery only for its intended purpose.

Never use any charger or battery which is damaged.

Do not short-circuit the battery. Accidental short-circuiting can occur when a metallic object (coin, clip or pen) causes direct connection of the + and - terminals of the battery (metal strips on the battery) for example when you carry a spare battery in your pocket or purse. Short-circuiting the terminals may damage the battery or the connecting object.

Leaving the battery in hot or cold places, such as in a closed car in summer or winter conditions, will reduce the capacity and lifetime of the battery. Always try to keep the battery between 15°C and 25°C (59°F and 77°F). A phone with a hot or cold battery may temporarily not work, even when the battery is fully charged. Batteries' performance is particularly limited in temperatures well below freezing.

Do not dispose of batteries in a fire!

Dispose of batteries according to local regulations (e.g. recycling). Do not dispose as household waste.

Company Policy

Our policy is of continuous development; details of all technical modifications will be included with service bulletins.

While every endeavour has been made to ensure the accuracy of this document, some errors may exist. If any errors are found by the reader, NOKIA MOBILE PHONES Business Group should be notified in writing/e-mail.

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Please send to:

NOKIA CORPORATION
Nokia Mobile Phones Business Group
Nokia Customer Care
PO Box 86
FIN-24101 SALO
Finland
E-mail: Service.Manuals@nokia.com

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Nokia 8600 Service Manual Structure

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2 Service Tools and Service Concepts
3 BB Troubleshooting and Manual Tuning Guide
4 RF Troubleshooting and Manual Tuning Guide
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Glossary

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1 — General information

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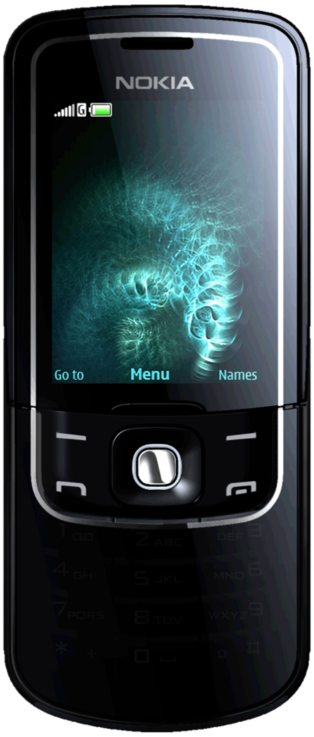
Product selection

The RM-164 phone is a quadband transceiver unit designed for the GSM850/900/1800/1900 networks, including EGSM.



Product features

Hardware characteristics

- MicroUSB for audio, data and charging (USB Version 2.0)
- Slide form factor
- Internal Bluetooth & GSM antenna with Quadband EGSM 850/900/1800/1900
- Class 2 and class 3 SIM ATK features
- Main display: QVGA 320x240, (24 bit) 16.7 million True Color TFT (active area 2”)
- Codecs & file formats: AAC, AAC+, eAAC+, MP3, MP4, MIDI, AMR, H.263, H.264, MPEG4, WMA Audio, JPEG, BMP, PNG, GIF, 3GPP
- Over 100 MB of internal memory for user data
- Integrated 2.0 Megapixel camera with 4x digital zoom
- Integrated FM Radio and MP3 Player
- Integrated handsfree speaker

Software and UI Features

- Demo mode (phone demo without SIM card)
- Flight mode (offline mode)
- FOTA: Firmware update over the air according OMA Device Management 1.2 (dependant on SW phone version and operator)

- Macromedia Flash Lite 1.1
- Bluetooth version 2.0 + Enhanced data rate

Bearers supported:

- Quadband EGSM 850/900/1800/1900
- HSCSD/CSD for browsing and as data modem
- GPRS (CS-4) and EGPRS (MSC-9)

Applications/Service Enablers:

- xHTML over TCP/IP
- MMS 1.2 (600k MMS size)
- Java MIDP 2.0 applications and games
- A2DP BT Stereo audio streaming
- Nokia XPress audio messaging
- OMA Client provisioning
- E-mail client with attachments
- Ringtones: MP3, true tones & 64 polyphony MIDI
- Video ring tones & MP3 music files, AAC, AAC+ eAAC+, H.263, H.264, WMA Audio
- OMA (remote) synchronization/local synch Smart content download - OMA DRM 1.0
- Printing & Nokia XpressPrint via Bluetooth

Other features

- Camcorder and video player
- Themes including e.g. animated wallpapers and screensavers, ringing tones
- SIND Speaker independent name dialing on long press volume down key
- User configurable right soft key & GoTo menu
- Organizer with calendar, To-do list and notes
- Alarm clock, Countdown timer
- Zoom via Side-Vol key when Camera is active

Accessories

Table 1 Battery and chargers

Type	Name
BP-5M	Battery 900mAh Li-polymer
AC-6	Charger
DC-6	

Table 2 Car accessories

Type	Name
N616	Car kit
N810	
CK-30W	
CK-20W	
CK-15W	
CR-39	Car holder
HF-33W	Wireless plug-in car handsfree
HF-34W	
HF-35W	
HF-6W	
HF-9W	

Table 3 Audio

Type	Name
BH-900 / BH-902	Bluetooth mono headset
BH-700 / BH-701	
BH-800 / BH-801 / BH-803	
BH-600 / BH-602	
HS-12W	Bluetooth stereo headset
HS-39W	
BH-903	
HS-40	Wired headset w microUSB adapter AD-55
HS-47	
HS-60	
HS-81	
AD-55	microUSB-Nokia AV audio adapter

Technical specifications

General specifications

Unit	Dimension (mm)	Weight (g)	Volume (cc)
Transceiver with BP-5M 900mAh Li-polymer battery pack	107x45x15.9	143	70

Battery endurance

Battery	Talk time	Standby time
BP-5M 900 mAh Li-polymer	Up to 3.7 hrs	Up to 10 days

Note: Variation in operation times will occur depending on SIM card, network settings and usage. Talk time is increased by up to 30% if half rate is active, and reduced by 5% if enhanced full rate is active.

Environmental conditions

Temperature

Temperature range	Min ºC	Max ºC
Operational (all specs met)	-10	+55
Functional (reduced performance)	-30	+70
Storage	-30	+85

The HW module complies with the SPR4 Operating Conditions.

Humidity

Relative humidity range is 5...95%.

The hardware module is not protected against water. Condensed or splashed water might cause malfunction. Any submerge of the phone will cause permanent damage. Long-term high humidity, with condensation, will cause permanent damage because of corrosion.

The hardware module complies with the SPR4 Operating Conditions.

Electrical characteristics

Table 4 Normal and extreme voltages

Voltage	Voltage (V)	Condition
	General conditions	
Nominal voltage	4.0	
Lower extreme voltage	3.4	a
Higher extreme voltage	4.2	b

Min operating voltage		
Voltage	Voltage (v)	Condition
Voltage limit to leave Power Off	2.95 +/- 0.1	Off to On
Voltage limit to enter Power Off	2.5 +/- 0.1	On to Off

a. ADC settings in the SW might shutdown the phone above this value.

b. During fast charging of an empty battery, this voltage might exceed this value. Voltages between 4.20 and 4.60 might appear for a short while.

Main RF characteristics

Table 5 Channel numbers and frequencies

System	Channel number	TX frequency	RX frequency	Unit
GSM850	128 <= n <= 251	F = 824.2 + 0.2*(n - 128)	F = 869.2 + 0.2*(n-128)	MHz
GSM900	0 < =n <= 124	F = 890 + 0.2*n	F = 935 + 0.2*n	MHz
	975 <= n <= 1023	F = 890 + 0.2* (n - 1024)	F = 935 + 0.2*(n -1024)	MHz
GSM1800	512 <= n <= 885	F = 1710.2 + 0.2* (n - 512)	F = 1805.2 + 0.2* (n-512)	MHz
GSM1900	512 <= n <= 810	F = 1850.2 + 0.2* (n - 512)	F = 1930.2 + 0.2* (n-512)	MHz

Table 6 Main RF characteristics

Parameter	Unit and value
Cellular systems	GSM850/EGSM900/GSM1800/GSM1900
RX Frequency range	GSM850: 869 ... 894 MHz
	EGSM900: 925 ... 960 MHz
	GSM1800: 1805...1880 MHz
	GSM1900: 1930...1990 MHz
TX Frequency range	GSM850: 824 ... 849 MHz
	EGSM900: 880 ... 915 MHz
	GSM1800: 1710 ...1785 MHz
	GSM1900: 1850...1910 MHz
Duplex spacing	GSM850: 45 MHz
	EGSM900: 45 MHz
	GSM1800: 95 MHz
	GSM1900: 80 MHz
Channel spacing	200 kHz

Parameter	Unit and value
Number of RF channels	GSM850: 124
	EGSM900: 174
	GSM1800: 374
	GSM1900: 300
Output Power	GSM850: GSMK 5...32.5 dBm
	GSM850: 8-PSK 5...26.5 dBm
	EGSM900: GSMK 5...32.5 dBm
	EGSM900: 8-PSK 5...26.5 dBm
	GSM1800: GSMK 0...30 dBm
	GSM1800: 8-PSK 0...25.5 dBm
	GSM1900: GSMK 0...30 dBm
	GSM1900: 8-PSK 0...25.5 dBm
Number of power levels GMSK	GSM850: 15
	EGSM900: 15
	GSM1800: 16
	GSM1900: 16
Number of power levels 8-PSK	GSM850: 12
	EGSM900: 12
	GSM1800: 14
	GSM1900: 14

Table 7 Transmitter characteristics

Item	Values
Type	Direct conversion, nonlinear, FDMA/TDMA
LO frequency range	GSM850: 3296...3576 MHz (4 x TX freq)
	EGSM900: 3520...3660 MHz (4 x TX freq)
	GSM1800: 3420...3570 MHz (2 x TX freq)
	GSM1900: 3700...3820 MHz (2 x TX freq)
Output power (GSM850/EGSM900/GSM1800/ GSM1900)	GMSK 32.5/32.5/30/30 dBm 8-PSK 26.5/26.5/25.5/25.5 dBm
Gain control range	GSMK 27/27/30/30 dB 8-PSK 21/21/25/25 dB
Phase error (RMS/peak), GMSK	5 deg./20 deg. peak
EVM (RMS/peak), 8-PSK	10%/30%

Table 8 Receiver characteristics

Item	Values
Type	Direct conversion, Linear, FDMA/TDMA
LO frequencies	GSM850: 3476..3576 MHz (4 x RX freq)
	EGSM900: 3700...3840 MHz (4 x RX freq)
	GSM1800: 3610...3760 MHz (2 x RX freq)
	GSM1900: 3860...3980 MHz (2 x RX freq)
Typical 3 dB bandwidth	+/- 91 kHz
Sensitivity	GSMK -102 dBm GPRS -99 dBm 8-PSK -86 dBm
Total typical receiver voltage gain (from antenna to RX ADC)	86 dB
Receiver output level (RF level -95 dBm)	40 mVpp, single-ended I/Q signals to RX ADCs

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2 — Service Tools and Service Concepts

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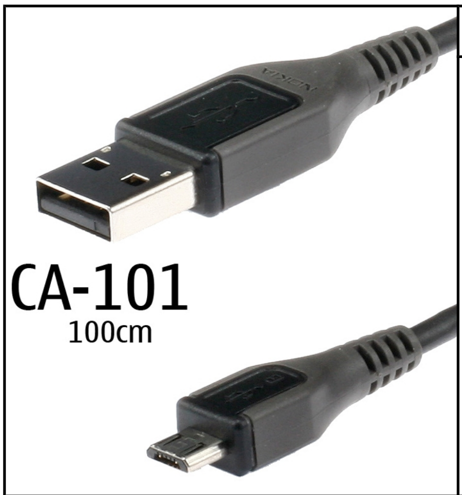
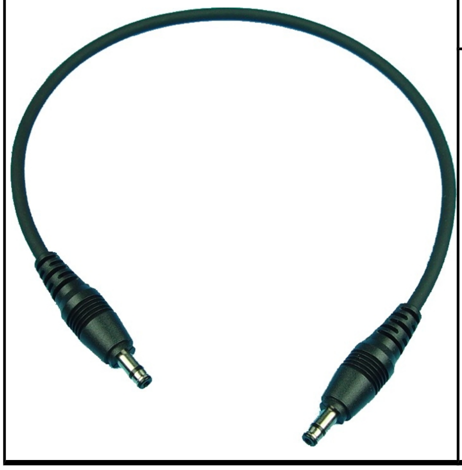
Service tools

The table below gives a short overview of service tools that can be used for testing, error analysis and repair of product RM-164, refer to various concepts.

	CA-101	Micro USB cable	
	The CA-101 is a USB-to-microUSB data cable that allows connections between the PC and the phone and also can be used to charge the phone from USB ports (PC suite needs to be installed in PC for charging via USB cable to work).		
	CA-35S	Power cable	
	CA-35S is a power cable for connecting, for example, the FPS-10 flash prommer to the Point-Of-Sales (POS) flash adapter.		

CU-4	Control unit	

CU-4 is a general service tool used with a module jig and/or a flash adapter. It requires an external 12 V power supply.

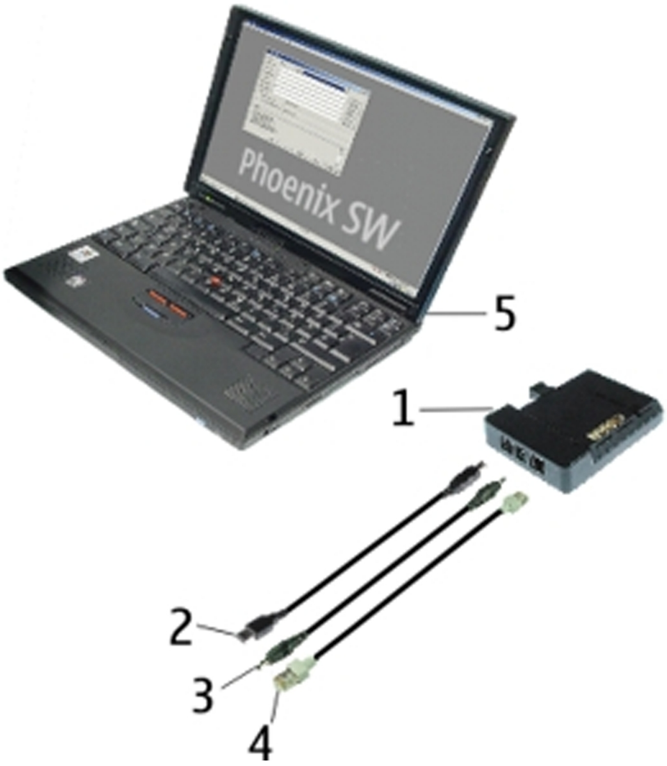
The unit has the following features:

- software controlled via USB
- EM calibration function
- Forwards FBUS/Flashbus traffic to/from terminal
- Forwards USB traffic to/from terminal
- software controlled BSI values
- regulated VBATT voltage
- 2 x USB2.0 connector (Hub)
- FBUS and USB connections supported

When using CU-4, note the special order of connecting cables and other service equipment:

Instructions

1 Connect a service tool (jig, flash adapter) to CU-4.
2 Connect CU-4 to your PC with a USB cable.
3 Connect supply voltage (12 V)
4 Connect an FBUS cable (if necessary).
5 Start Phoenix service software.

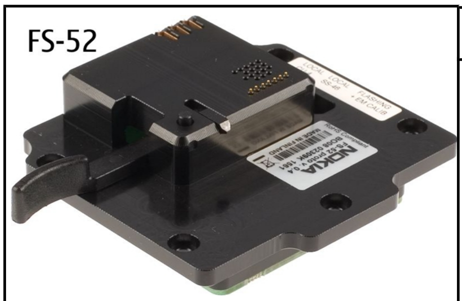


Note: Phoenix enables CU-4 regulators via USB when it is started.

Reconnecting the power supply requires a Phoenix restart.

	DAU-9S	MBUS cable	The MBUS cable DAU-9S has a modular connector and is used, for example, between the PC's serial port and module jigs, flash adapters or docking station adapters. **Note:** Docking station adapters valid for DCT4 products.
	FLS-5	Flash device	FLS-5 is a dongle and flash device incorporated into one package, developed specifically for POS use.
	FPS-10	Flash prommer	FPS-10 interfaces with: • PC • Control unit • Flash adapter • Smart card FPS-10 flash prommer features: • Flash functionality for BB5 and DCT-4 terminals • Smart Card reader for SX-2 or SX-4 • USB traffic forwarding • USB to FBUS/Flashbus conversion • LAN to FBUS/Flashbus and USB conversion • Vusb output switchable by PC command FPS-10 sales package includes: • FPS-10 prommer • Power Supply with 5 country specific cords • USB cable

FS-52



FS-52	Flash adaptor	

FS-52 is an interface between a phone the SS-46 and/or the SS-62 devices. It is used for testing, EM calibration and flashing assembled phones.

Features include:

- Used with SS-46 for phone flashing.
- Used with CU-4 for flashing and management calibration.
- Used with SA-130 RF coupler for go/no-go RF tests.
- Easy phone attachment and detachment.
- Reliable phone locking.
- Replaceable test pins.

Phone Mounting Instructions:

1 At an angle, align the battery connector blades to adaptor battery connector clips.

2 Ensure blades lock into adaptor clips.

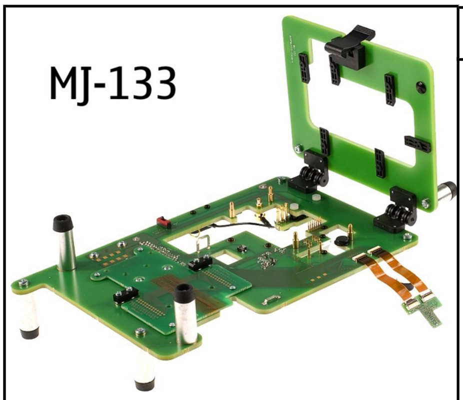
3 Carefully lower phone down while pulling pin lock lever back.

4 Once phone is properly seated, release the locking pin lever to lock phone.

5 Verify phone comes up in the chosen selected mode.

Note: Always use adaptor lever before removing phone from adaptor, otherwise, adaptor locking pin could break.

MJ-133



MJ-133	Module jig	

The MJ-133 is used for component level troubleshooting of the RM-164 engine board. It also allows engine testing, auto-tuning and troubleshooting.

Mj-133 provides:

- mechanical interface for engine module
- connections to all needed test pads in module (except for RF)
- permanent connection and locking of complete phone UI
- IHF speaker

Power is supplied via CU-4 (not part for MJ-133 sales pack)

The following parts are also needed to use the MJ-133, but are not part of the MJ-133 sales pack:

- CU-4 (for powering the MJ-133)
- CA-56RS (for RF tuning and testing)
- RM-164 UI Module (for UI related tests)
- AD-55 Audio Adaptor (for Audio testing)

Spare parts

- All test pins are replaceable.
- Flex assembly with connector.
- UI board with connector.
-

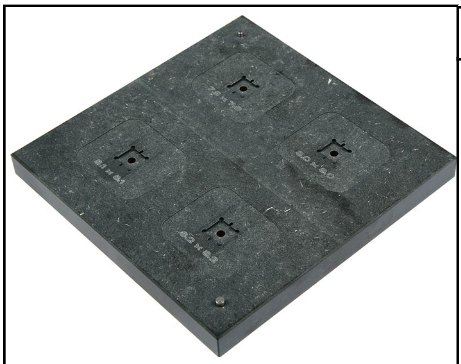
Table 9 Attenuation values for MJ-133

Band	Tuning Channel	Attn RX	Toler. RX	Attn TX	Toler. TX
GSM850	190	0.25	+/-0.1	0.2	+/-0.05
GSM900	38	0.3	+/-0.05	0.15	-2
GSM 1800	700	0.4	+/-0.05	0.4	-0.5
GSM 1900	660	0.4	-2	0.4	+/-0.05

PCS-1	Power cable	

The PCS-1 power cable (DC) is used with a docking station, a module jig or a control unit to supply a controlled voltage.

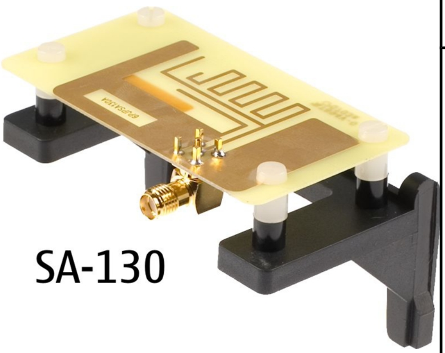
<table>
<tr><td rowspan="2"> </td><td>PK-1</td><td>Software protection key</td><td></td></tr>
<tr><td colspan="3">PK-1 is a hardware protection key with a USB interface. It has the same functionality as the PKD-1 series dongle.
PK-1 is meant for use with a PC that does not have a series interface.
To use this USB dongle for security service functions please register the dongle in the same way as the PKD-1 series dongle.</td></tr>
<tr><td rowspan="2"> </td><td>PKD-1</td><td>SW security device</td><td></td></tr>
<tr><td colspan="3">SW security device is a piece of hardware enabling the use of the service software when connected to the parallel (LPT) port of the PC.
Without the device, it is not possible to use the service software.
Printer or any such device can be connected to the PC through the device if needed.</td></tr>
<tr><td rowspan="2">RJ-167
 </td><td>RJ-167</td><td>Soldering jig</td><td></td></tr>
<tr><td colspan="3">This soldering jig is used for module level repair, either as fixation in µBGA rework places or when there is a need to hold a module on the work bench for any other repair.
Features include:
• Convenient locking mechanism
• Four (optional mount) rubber feet allow usage also on repair benches
• Fixation of phone module in both ways possible (bottom or top side up)
• ESD proof material
• Standard uBGA jig thickness and outer dimensions</td></tr>
<tr><td rowspan="2"> </td><td>RJ-184</td><td>Rework jig</td><td></td></tr>
<tr><td colspan="3">RJ-184 is used as a rework jig for the engine module.
This jig is used in conjunction with the ST-61 stencil for spreading the soldering paste to the B2201 component.</td></tr>
<tr><td rowspan="2"> </td><td>RJ-18</td><td>Rework jig</td><td></td></tr>
<tr><td colspan="3">RJ-18 is used as a rework jig for the engine module.
This jig is used in conjunction with the ST-60 stencil for spreading the soldering paste to the D2300 component.</td></tr>
</table>



RJ-93	Rework jig	

RJ-93 is used as a rework jig for the engine module.

This jig is used in conjunction with the ST-40 stencil for spreading the soldering paste to the N7501 component.



SA-130

SA-130	RF coupler	

The SA-130 coupler is for GSM RF Go/No Go testing. It interfaces with the FS-52 and SS-62/CU-4 interface adapters. It allows RF function testing in GSM bands of 850, 900, 1800 and 1900 MHz.

Note: SA-130 is not suitable for RF tuning.

- **Table 10 Attenuation values**

Band	Channel	Freq.	TX Attn (dBm)	Freq.	RX Attn (dBm)
GSM850	Low	824.2	-16.1	869.2	-14.2
	Mid	836.6	-15.1	881.6	-13.4
	High	848.8	-14.9	893.8	-12.5
EGSM 900	Low	880.2	-12	925.2	-12.8
	Mid	897.6	-11.8	942.6	-14.4
	High	914.8	-12.1	959.8	-17
GSM 1800	Low	1710.2	-8.4	1805.2	-6.8
	Mid	1747.6	-7.5	1842.6	-6.7
	High	1784.8	-6.9	1879.8	-6.5
GSM 1900	Low	1850.2	-6.7	1930.2	-7.3
	Mid	1880	-6.5	1960	-8
	High	1909.8	-6.8	1989.8	-8.4

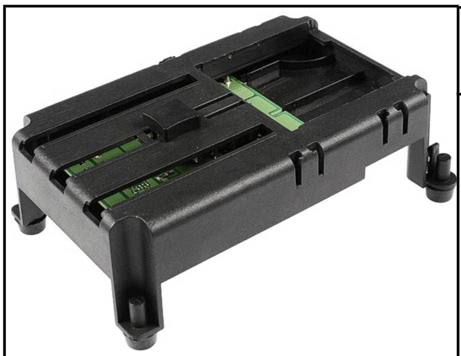
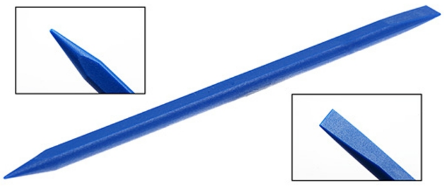
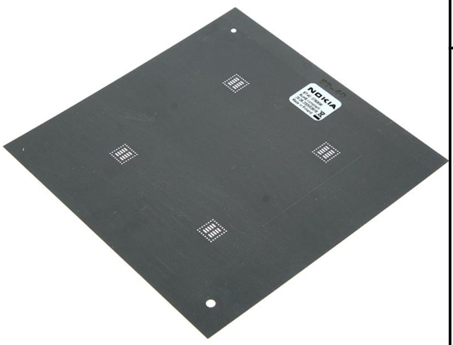
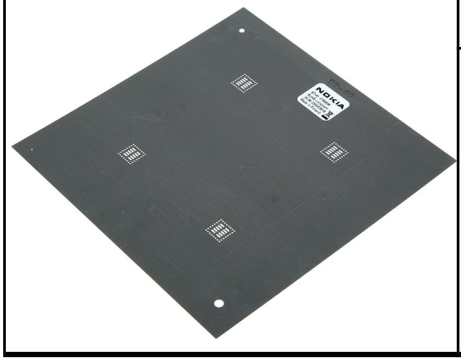
TX attenuation tolerance is +/- 1.0 dB

RX attenuation tolerance is +/- 1.0 dB

<table>
<tr><td rowspan="2">

NOKIA
RF-I/O
CLASS 1
STATUS
BER TEST
FBUS
POWER

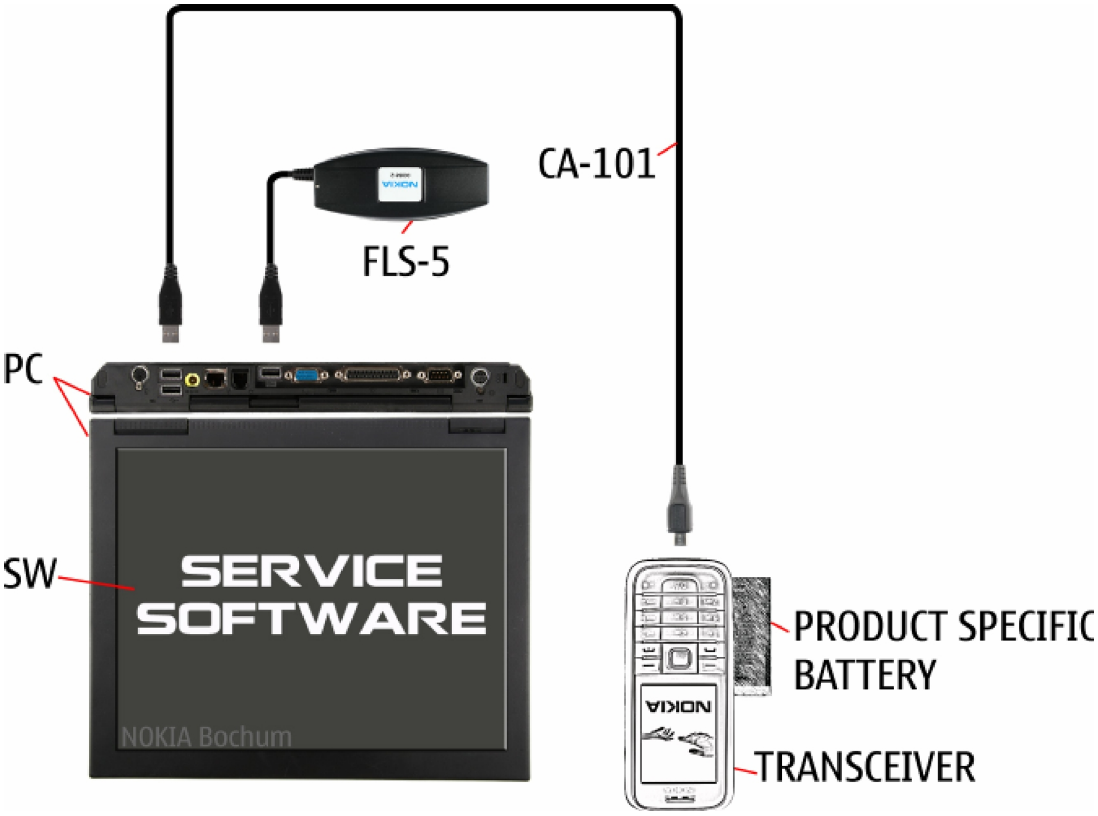
</td><td>SB-6</td><td>Bluetooth test and interface box (sales package)</td><td></td></tr>
<tr><td colspan="3">The SB-6 test box is a generic service device used to perform Bluetooth bit error rate (BER) testing, and establishing cordless FBUS connection via Bluetooth. An ACP-8x charger is needed for BER testing and an AXS-4 cable in case of cordless interface usage testing .
Sales package includes:
• SB-6 test box
• Installation and warranty information</td></tr>
<tr><td rowspan="2"></td><td>SPS-1</td><td>Soldering Paste Spreader</td><td></td></tr>
<tr><td colspan="3">The SPS-1 allows spreading of solder to the LGA components pads over the rework stencils.</td></tr>
<tr><td rowspan="2"> </td><td>SRT-6</td><td>Opening tool</td><td></td></tr>
<tr><td colspan="3">SRT-6 is used to open phone covers.</td></tr>
<tr><td rowspan="2"> </td><td>SS-45</td><td>Front camera removal tool</td><td></td></tr>
<tr><td colspan="3">The front camera removal tool SS-45 is used to remove/attach the front camera module from/to the socket.</td></tr>
<tr><td rowspan="2"> </td><td>SS-46</td><td>Interface adapter</td><td></td></tr>
<tr><td colspan="3">SS-46 acts as an interface adapter between the flash adapter and FPS-10.</td></tr>
</table>

<table>
<tr><td rowspan="2"></td><td>SS-62</td><td>Generic flash adapter base for BB5</td><td></td></tr>
<tr><td colspan="3">• generic base for flash adapters and couplers
• SS-62 equipped with a clip interlock system
• provides standardised interface towards Control Unit
• provides RF connection using galvanic connector or coupler
• multiplexing between USB and FBUS media, controlled by VUSB</td></tr>
<tr><td rowspan="2"></td><td>SS-93</td><td>Blue stick tool</td><td></td></tr>
<tr><td colspan="3">SS-93 is used for general disassembly and assembly tasks.</td></tr>
<tr><td rowspan="2"> </td><td>ST-40</td><td>Rework stencil</td><td></td></tr>
<tr><td colspan="3">ST-40 is a rework stencil and used with RJ-93.</td></tr>
<tr><td rowspan="2"></td><td>ST-60</td><td>Rework stencil</td><td></td></tr>
<tr><td colspan="3">ST-60 is a rework stencil and used with RJ-18.</td></tr>
<tr><td rowspan="2"></td><td>ST-61</td><td>Rework stencil</td><td></td></tr>
<tr><td colspan="3">ST-61 is a rework stencil and used with RJ-184.</td></tr>
</table>

<table>
<tr><td rowspan="2"> </td><td>SX-4</td><td>Smart card</td><td></td></tr>
<tr><td colspan="3">SX-4 is a BB5 security device used to protect critical features in tuning and testing.
SX-4 is also needed together with FPS-10 when DCT-4 phones are flashed.</td></tr>
<tr><td rowspan="2"> </td><td>XCS-4</td><td>Modular cable</td><td></td></tr>
<tr><td colspan="3">XCS-4 is a shielded (one specially shielded conductor) modular cable for flashing and service purposes.</td></tr>
<tr><td rowspan="2"> </td><td>XRS-6</td><td>RF cable</td><td></td></tr>
<tr><td colspan="3">The RF cable is used to connect, for example, a module repair jig to the RF measurement equipment.
SMA to N-Connector approximately 610 mm.
Attenuation for:
• GSM850/900: 0.3+-0.1 dB
• GSM1800/1900: 0.5+-0.1 dB</td></tr>
</table>

Service concepts

POS (Point of Sale) flash concept


CA-101
FLS-5
PC
SW
SERVICE SOFTWARE
NOKIA Bochum
PRODUCT SPECIFIC BATTERY
TRANSCEIVER

Type	Description
Product specific tools	
BP-5M	Battery
Other tools	
FLS-5	POS flash dongle
	PC with Phoenix service software
Cables	
CA-101	Micro USB cable

Flash concept with FPS-10

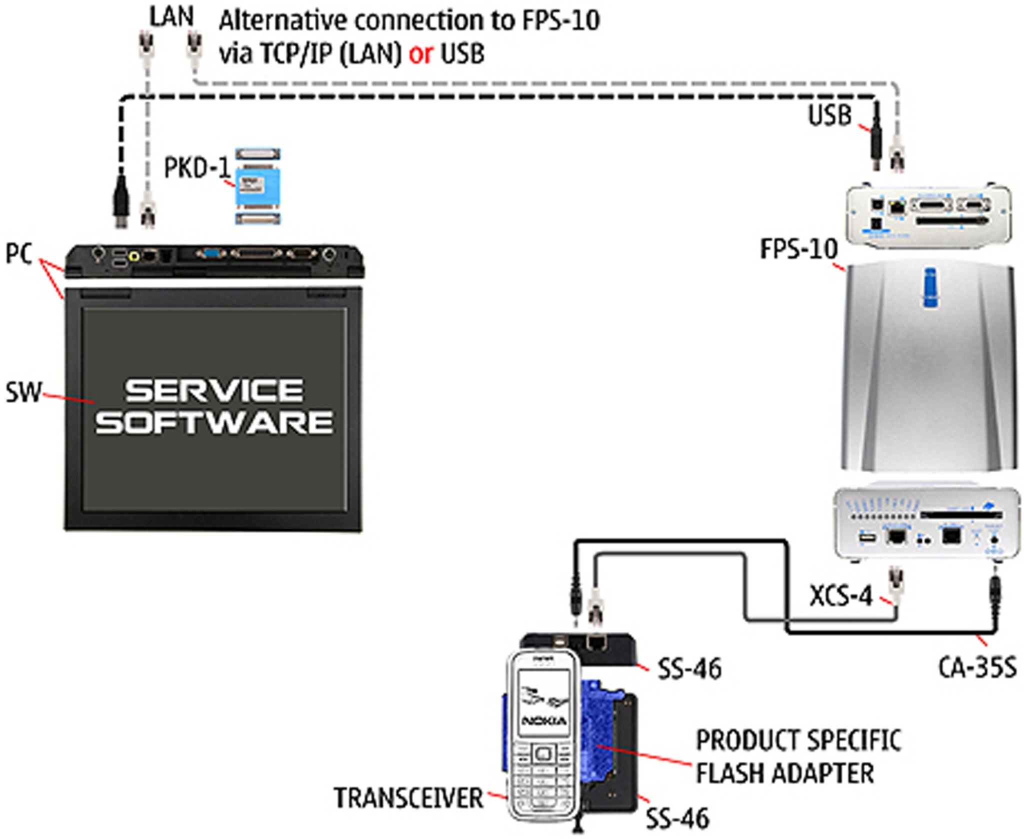

LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
USB
PKD-1
PC
FPS-10
SW
SERVICE
SOFTWARE
XCS-4
SS-46
CA-35S
PRODUCT SPECIFIC
FLASH ADAPTER
TRANSCEIVER
SS-46

Figure 1 Basic flash concept with FPS-10

Type	Description
Product specific devices	
FS-52	Flash adapter
Other devices	
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-46	Interface adapter
	PC with Phoenix service software
Cables	
XCS-4	Modular cable
CA-35S	Power cable
	USB cable

CU-4 flash concept with FPS-10

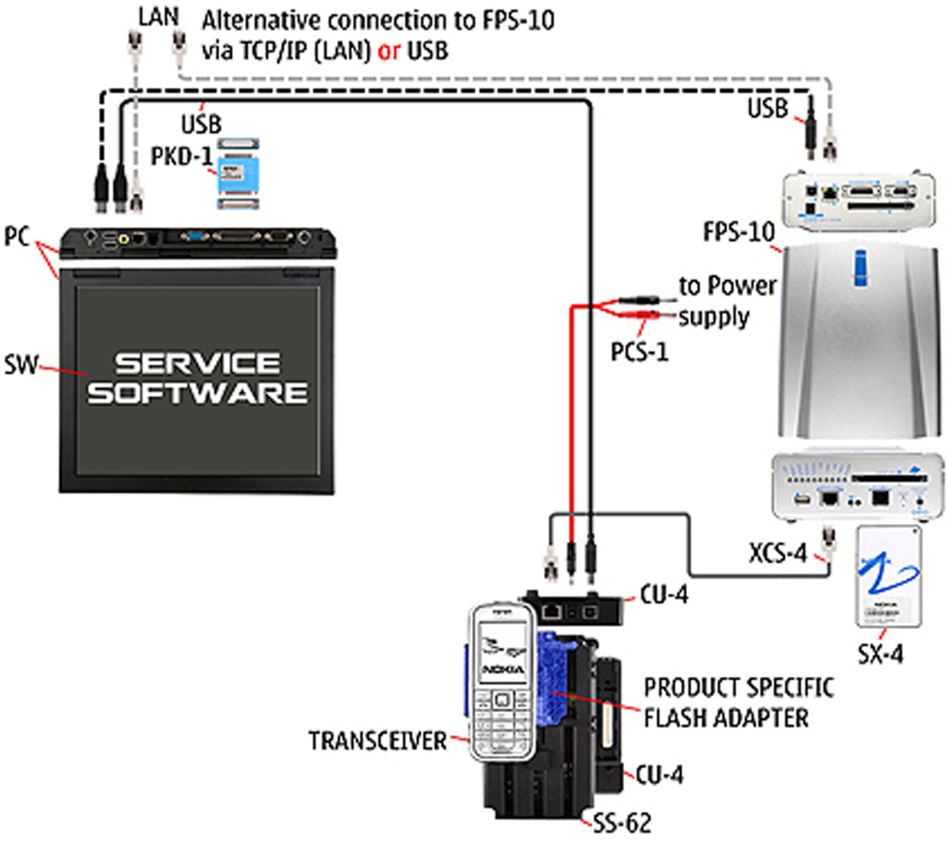

LAN
Alternative connection to FPS-10 via TCP/IP (LAN) or USB
USB
PKD-1
USB
PC
FPS-10
to Power supply
PCS-1
SW
SERVICE SOFTWARE
XCS-4
CU-4
SX-4
PRODUCT SPECIFIC FLASH ADAPTER
TRANSCEIVER
CU-4
SS-62

Figure 2 CU-4 flash concept with FPS-10

Type	Description
Product specific devices	
FS-52	Flash adapter
Other devices	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
SX-4	Smart card
	PC with Phoenix service software
Cables	
PCS-1	Power cable
XCS-4	Modular cable
	Standard USB cable
	USB cable

RF testing concept with RF coupler

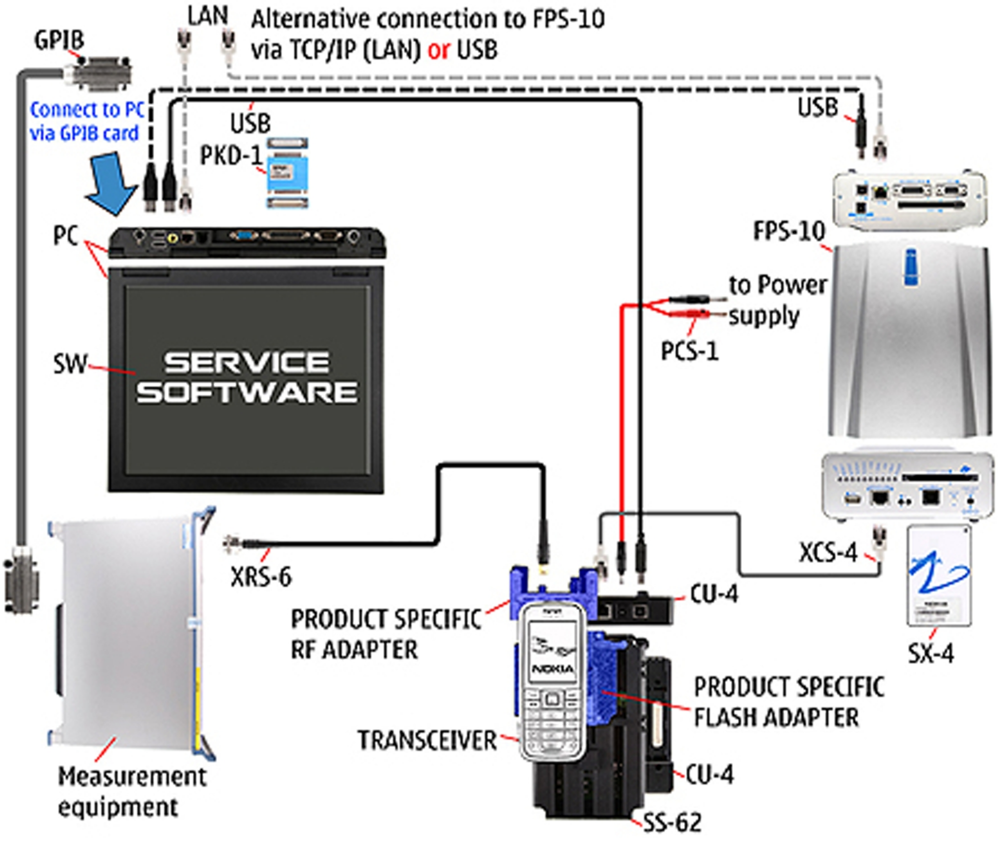

LAN
Alternative connection to FPS-10 via TCP/IP (LAN) or USB
GPIB
Connect to PC via GPIB card
USB
PKD-1
USB
FPS-10
PC
to Power supply
PCS-1
SW
SERVICE SOFTWARE
XRS-6
XCS-4
CU-4
PRODUCT SPECIFIC RF ADAPTER
SX-4
PRODUCT SPECIFIC FLASH ADAPTER
TRANSCEIVER
CU-4
Measurement equipment
SS-62

Figure 3 RF testing concept with RF coupler

Type	Description
Product specific devices	
FS-52	Flash adapter
SA-130	RF coupler
Other devices	
CU-4	Control unit
SX-4	Smart card
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
	Measurement equipment
	PC with Phoenix service software
Cables	
PCS-1	Power cable
XCS-4	Modular cable
XRS-6	RF cable

Type	Description
	GPIB control cable
	USB cable

Service concept for RF testing and RF/BB tuning

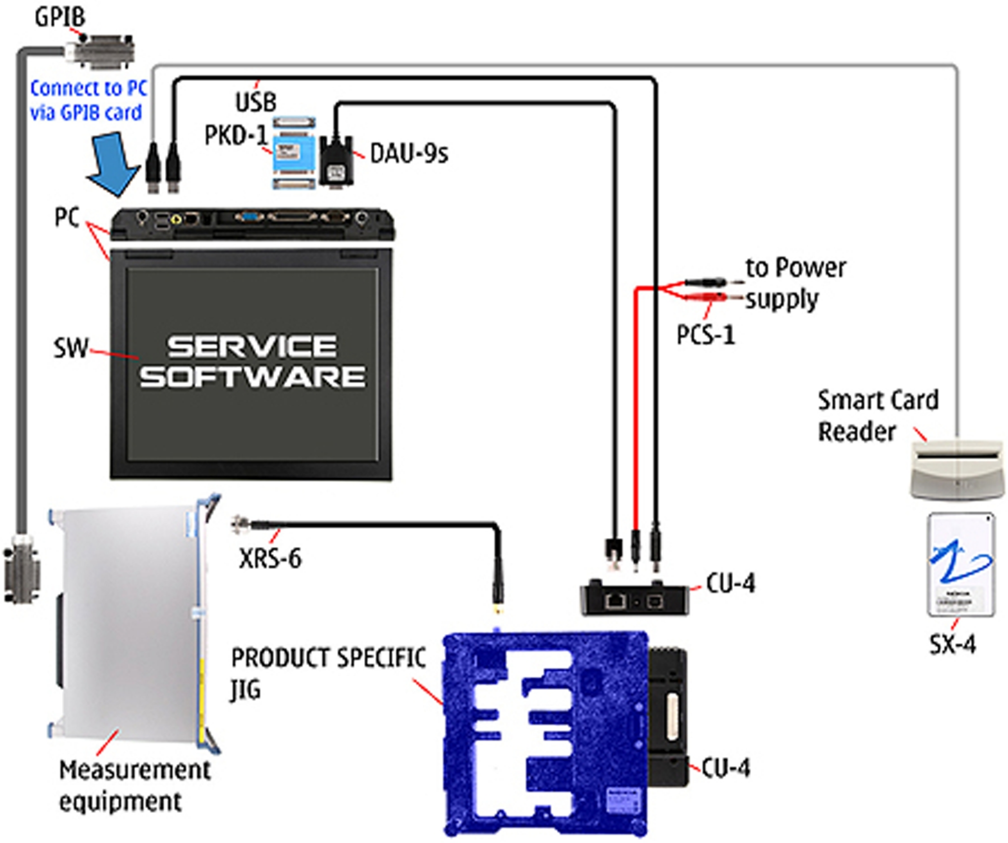

GPIB
Connect to PC via GPIB card
USB
PKD-1
DAU-9s
PC
SW
SERVICE SOFTWARE
to Power supply
PCS-1
Smart Card Reader
XRS-6
CU-4
SX-4
PRODUCT SPECIFIC JIG
CU-4
Measurement equipment

Figure 4 Service concept for RF testing and RF/BB tuning

Type	Description
Product specific devices	
MJ-133	Module jig
Other devices	
CU-4	Control unit
PKD-1/PK-1	SW security device
SX-4	Smart card
	Measurement equipment
	Smart card reader
	PC with Phoenix service software
Cables	
DAU-9s	MBUS cable

Type	Description
PCS-1	DC power cable
XRS-6	RF cable
	GPIB control cable
	USB cable

Module jig service concept

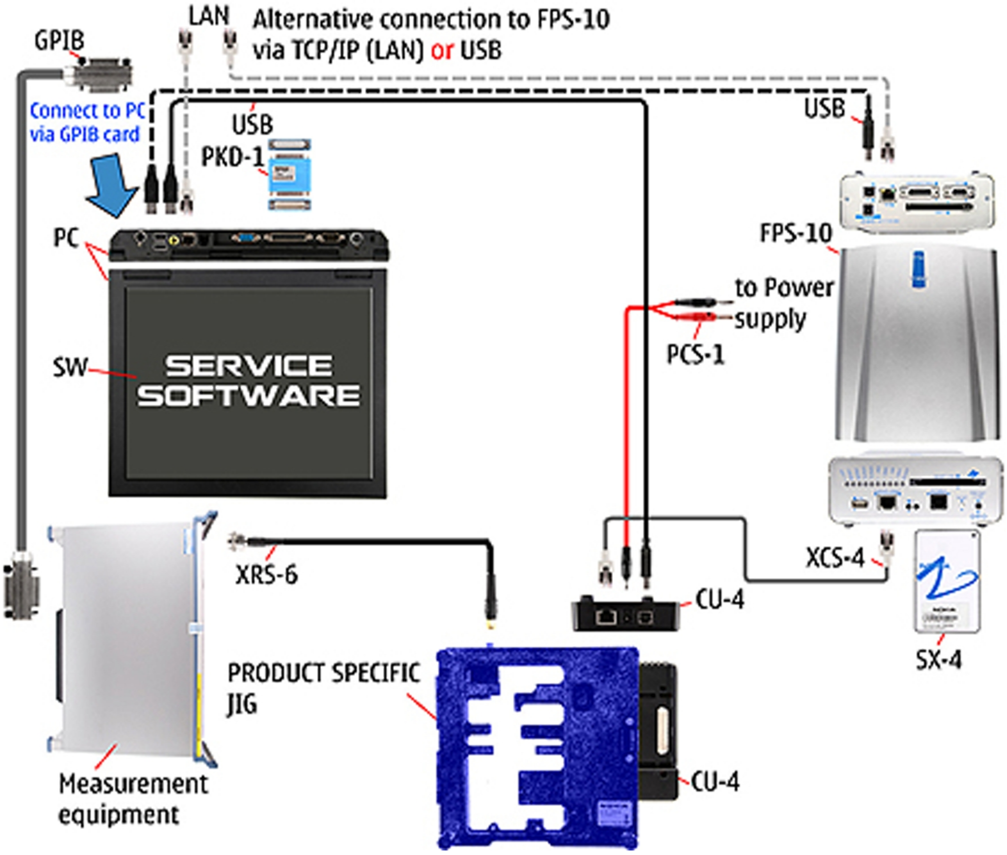

LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
GPIB
Connect to PC
via GPIB card
USB
PKD-1
USB
PC
FPS-10
to Power
supply
PCS-1
SW
SERVICE
SOFTWARE
XCS-4
XRS-6
CU-4
SX-4
PRODUCT SPECIFIC
JIG
CU-4
Measurement
equipment

Figure 5 Module jig service concept

Type	Description
Phone specific devices	
MJ-133	Module jig
Other devices	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SX-4	Smart card
	PC with Phoenix service software
	Measurement equipment

Type	Description
Cables	
PCS-1	DC power cable
XCS-4	Modular cable
XRS-6	RF cable
	USB cable
	GPIB control cable

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3 — BB Troubleshooting and Manual Tuning Guide

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  Battery current measuring fault troubleshooting 3–6
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Baseband troubleshooting overview

This section is intended to be a guide for localising and repairing electrical faults.

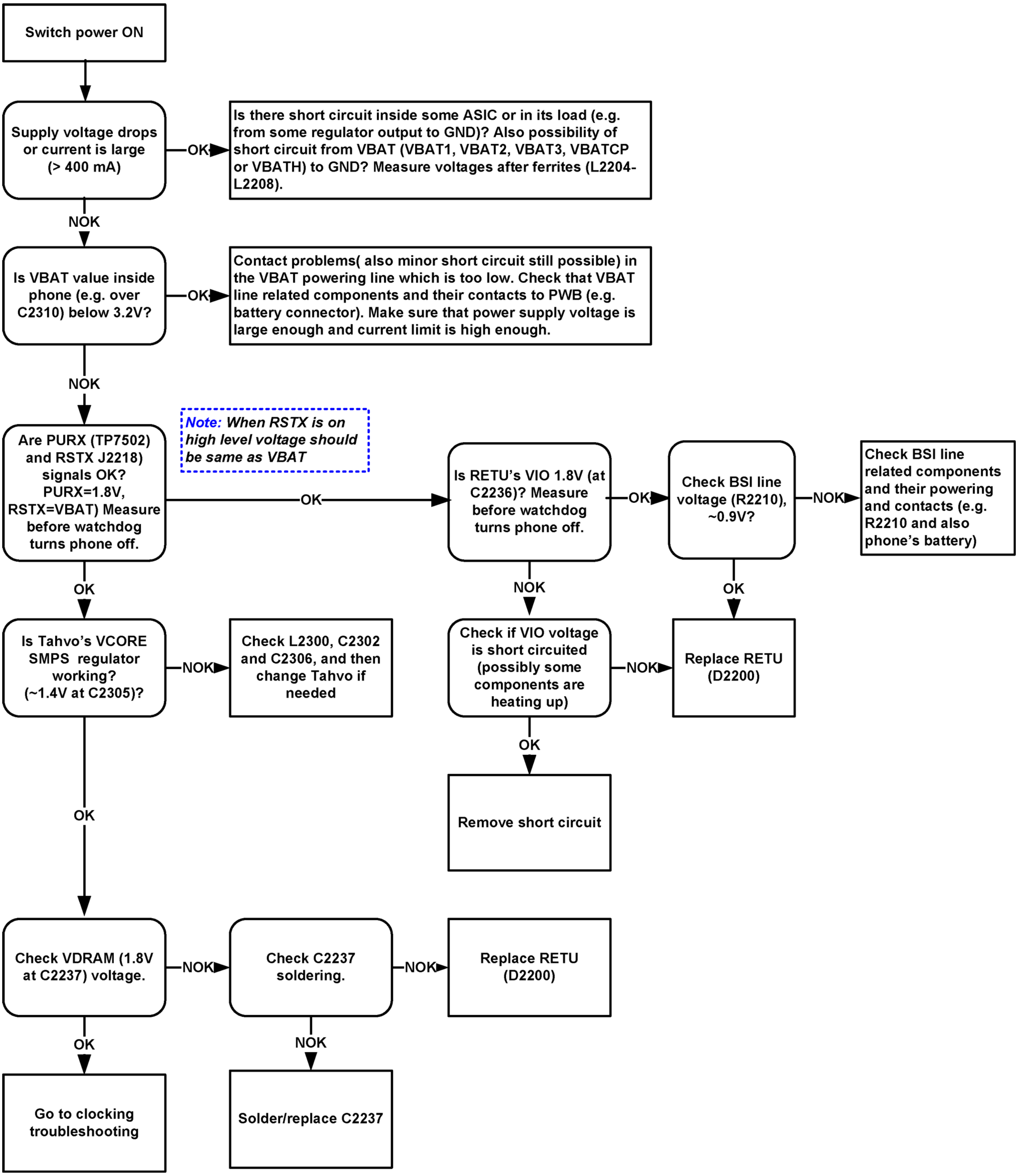
The table below tells you what troubleshooting to go to.

Problem	Troubleshooting
Abnormal current consumption	1 General power checking troubleshooting (page 3–6) 2 Battery current measuring fault troubleshooting (page 3–6)
Flashing does not work or the problem is not clearly defined	1 Flash programming fault troubleshooting (page 3–16) 2 Clocking troubleshooting (page 3–9) 3 Combo memory troubleshooting (page 3–14)
Charging does not work	Charging troubleshooting (page 3–8)
Display does not work	Display troubleshooting (page 3–23)
Backlights do not work	1 Backlight troubleshooting (page 3–24) 2 LED driver troubleshooting (page 3–25)
USB does not work	USB troubleshooting (page 3–49)
Audio (mic, earpiece, IHF) does not work	1 Audio troubleshooting (page 3–27) 2 Acoustics troubleshooting (page 3–36)
Camera does not work	Camera troubleshootoing (page 3–11)
Slide sensor detection	MR sensor troubleshooting (page 3–27)
Bluetooth does not work	Bluetooth troubleshooting (page 3–39)
FM radio does not work	FM radio troubleshooting (page 3–18)

Power and charging troubleshooting

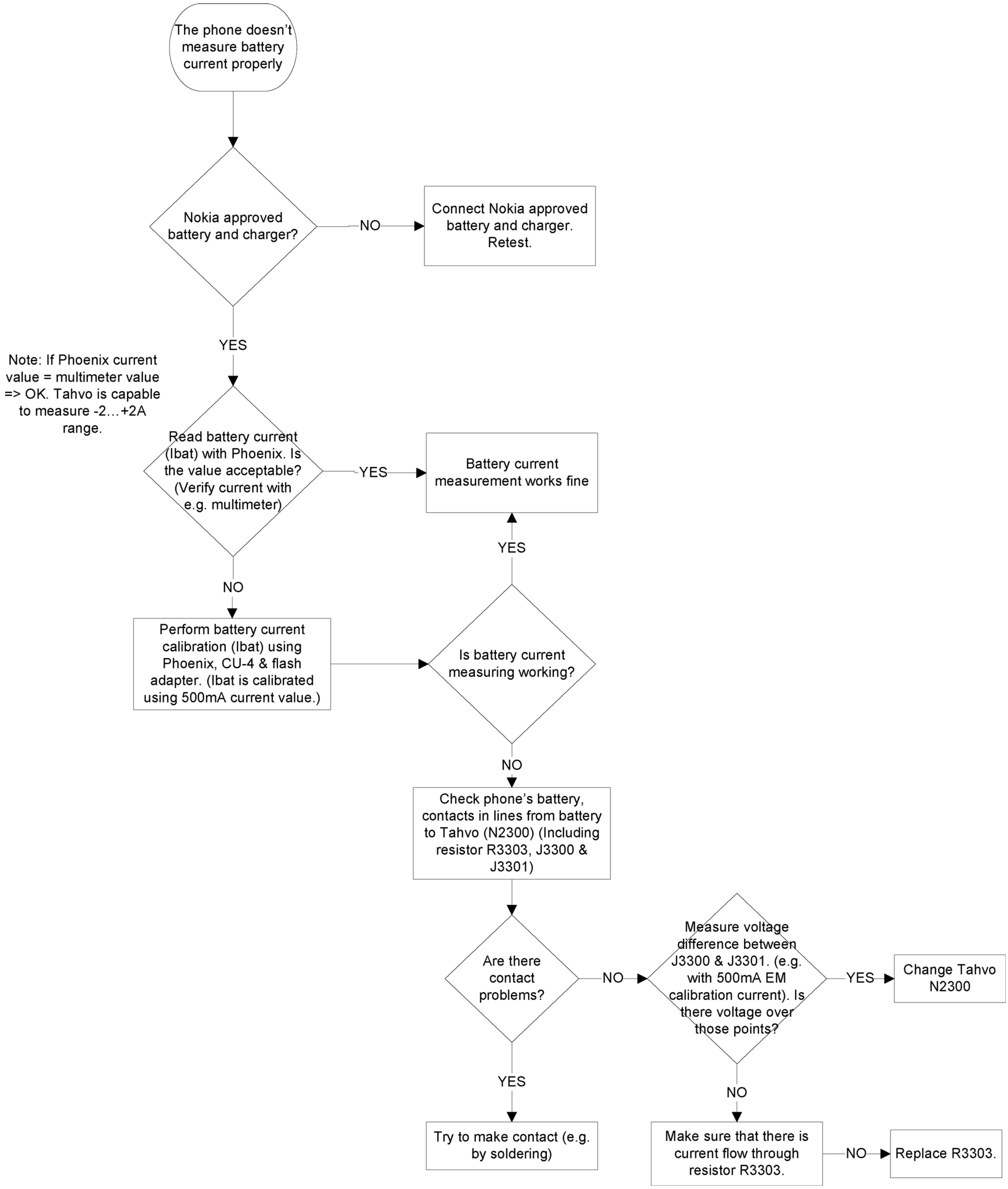
General power checking troubleshooting

Troubleshooting flow


Switch power ON
Supply voltage drops or current is large (> 400 mA)
OK
Is there short circuit inside some ASIC or in its load (e.g. from some regulator output to GND)? Also possibility of short circuit from VBAT (VBAT1, VBAT2, VBAT3, VBATCP or VBATH) to GND? Measure voltages after ferrites (L2204-L2208).
NOK
Is VBAT value inside phone (e.g. over C2310) below 3.2V?
OK
Contact problems(also minor short circuit still possible) in the VBAT powering line which is too low. Check that VBAT line related components and their contacts to PWB (e.g. battery connector). Make sure that power supply voltage is large enough and current limit is high enough.
NOK
Note: When RSTX is on high level voltage should be same as VBAT
Are PURX (TP7502) and RSTX J2218) signals OK? PURX=1.8V, RSTX=VBAT) Measure before watchdog turns phone off.
OK
Is RETU's VIO 1.8V (at C2236)? Measure before watchdog turns phone off.
OK
Check BSI line voltage (R2210), ~0.9V?
NOK
Check BSI line related components and their powering and contacts (e.g. R2210 and also phone's battery)
OK
Replace RETU (D2200)
NOK
Check if VIO voltage is short circuited (possibly some components are heating up)
NOK
OK
Remove short circuit
OK
Is Tahvo's VCORE SMPS regulator working? (~1.4V at C2305)?
NOK
Check L2300, C2302 and C2306, and then change Tahvo if needed
OK
Check VDRAM (1.8V at C2237) voltage.
NOK
Check C2237 soldering.
NOK
Replace RETU (D2200)
OK
Go to clocking troubleshooting
NOK
Solder/replace C2237

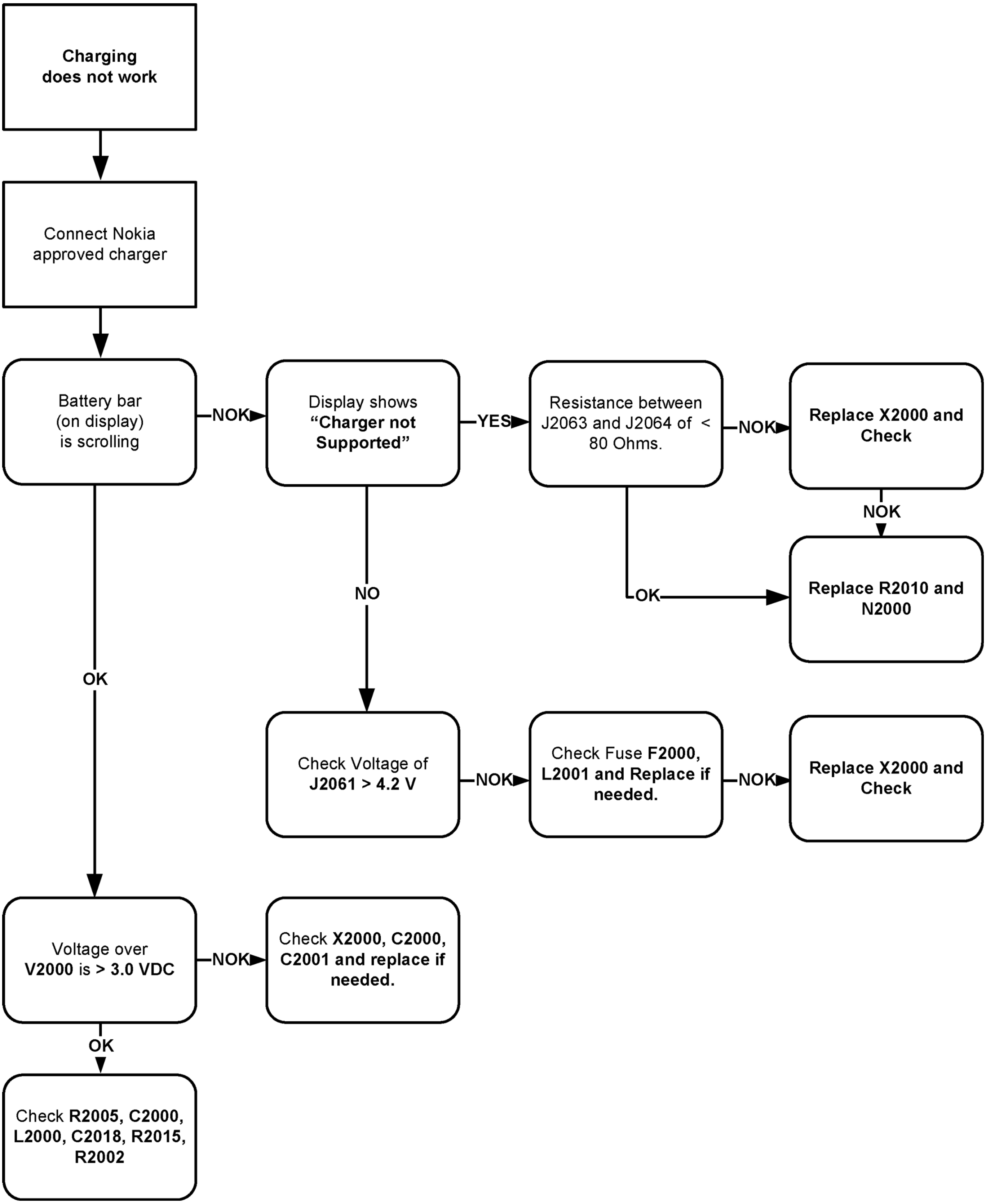
Battery current measuring fault troubleshooting

Troubleshooting flow


The phone doesn't measure battery current properly
Nokia approved battery and charger?
NO
Connect Nokia approved battery and charger. Retest.
YES
Note: If Phoenix current value = multimeter value => OK. Tahvo is capable to measure -2…+2A range.
Read battery current (Ibat) with Phoenix. Is the value acceptable? (Verify current with e.g. multimeter)
YES
Battery current measurement works fine
NO
Perform battery current calibration (Ibat) using Phoenix, CU-4 & flash adapter. (Ibat is calibrated using 500mA current value.)
YES
Is battery current measuring working?
NO
Check phone's battery, contacts in lines from battery to Tahvo (N2300) (Including resistor R3303, J3300 & J3301)
Are there contact problems?
NO
Measure voltage difference between J3300 & J3301. (e.g. with 500mA EM calibration current). Is there voltage over those points?
YES
Change Tahvo N2300
YES
Try to make contact (e.g. by soldering)
NO
Make sure that there is current flow through resistor R3303.
NO
Replace R3303.

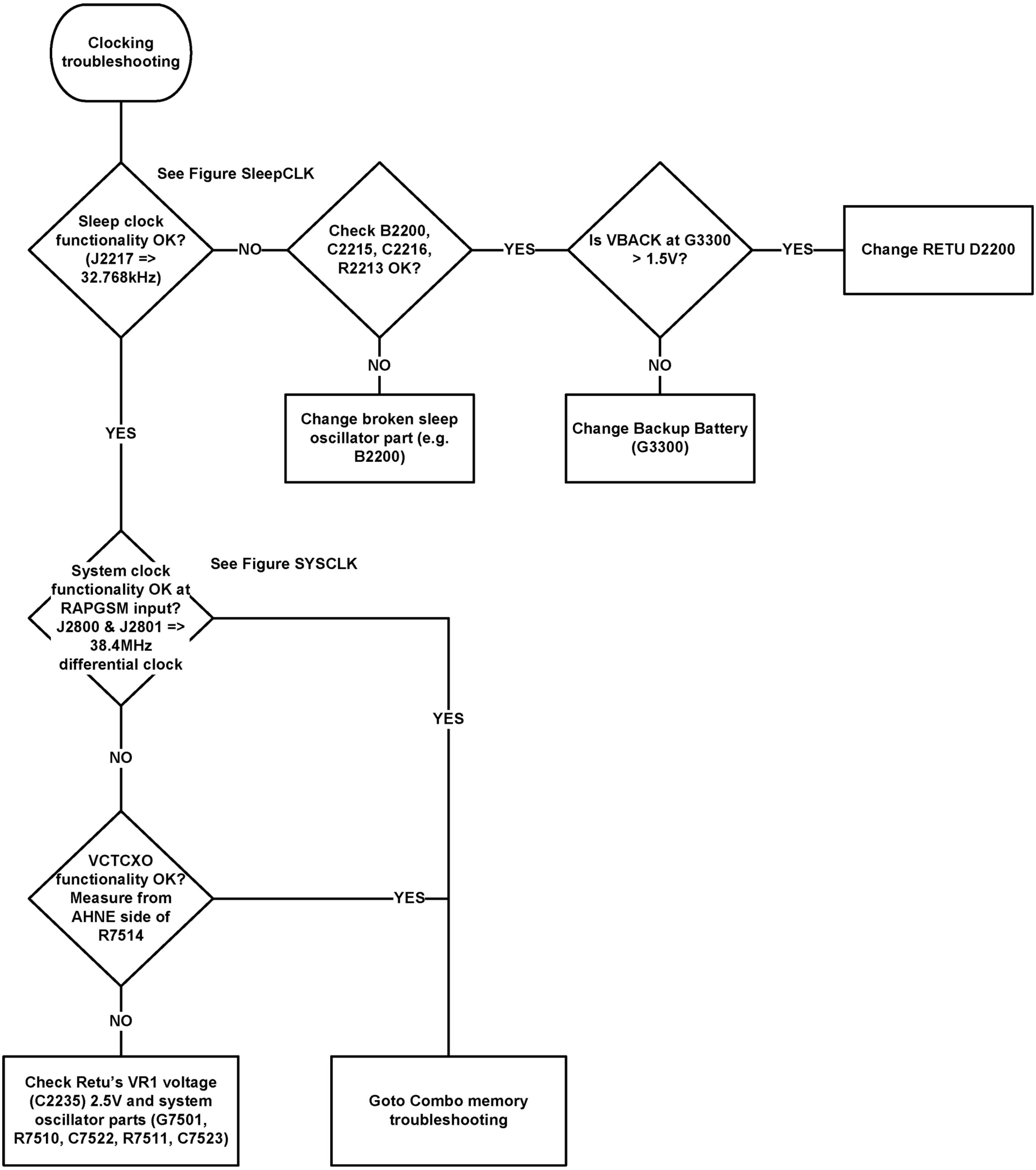
Charging troubleshooting

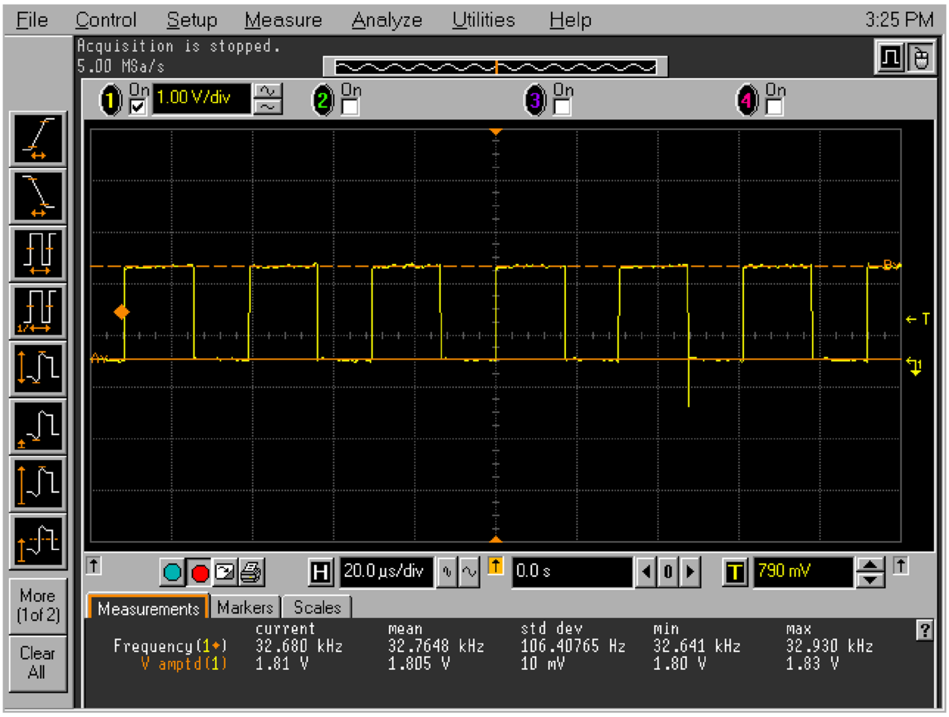
Troubleshooting flow


Charging does not work
Connect Nokia approved charger
Battery bar (on display) is scrolling
NOK
Display shows "Charger not Supported"
YES
Resistance between J2063 and J2064 of < 80 Ohms.
NOK
Replace X2000 and Check
NOK
Replace R2010 and N2000
OK
NO
OK
Check Voltage of J2061 > 4.2 V
NOK
Check Fuse F2000, L2001 and Replace if needed.
NOK
Replace X2000 and Check
Voltage over V2000 is > 3.0 VDC
NOK
Check X2000, C2000, C2001 and replace if needed.
OK
Check R2005, C2000, L2000, C2018, R2015, R2002

Clocking troubleshooting

Troubleshooting flow


Clocking troubleshooting
See Figure SleepCLK
Sleep clock functionality OK? (J2217 => 32.768kHz)
NO
Check B2200, C2215, C2216, R2213 OK?
YES
Is VBACK at G3300 > 1.5V?
YES
Change RETU D2200
NO
Change broken sleep oscillator part (e.g. B2200)
NO
Change Backup Battery (G3300)
YES
See Figure SYSCLK
System clock functionality OK at RAPGSM input? J2800 & J2801 => 38.4MHz differential clock
YES
NO
VCTCXO functionality OK? Measure from AHNE side of R7514
YES
NO
Check Retu's VR1 voltage (C2235) 2.5V and system oscillator parts (G7501, R7510, C7522, R7511, C7523)
Goto Combo memory troubleshooting

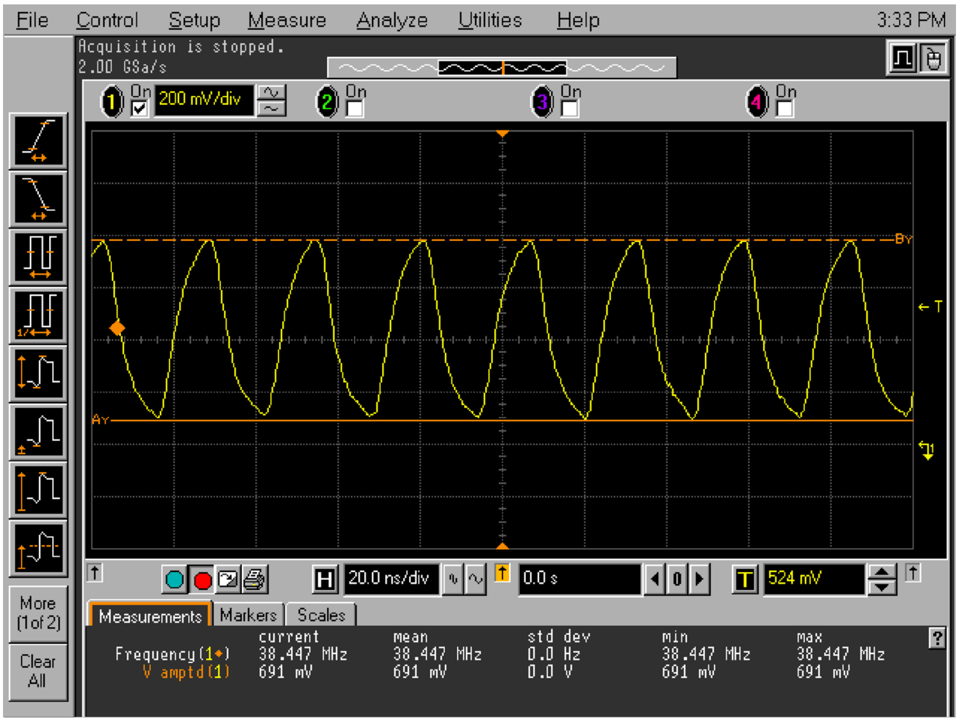


File
Control
Setup
Measure
Analyze
Utilities
Help
3:25 PM
On
1.00 V/div
On
On
On
20.0 µs/div
0.0 s
790 mV
More (1 of 2)
Clear All
Measurements
Markers
Scales

```
Acquisition is stopped.
5.00 MSa/s
```

```
                  current      mean          std dev        min          max
Frequency(1•)     32.680 kHz   32.7648 kHz   106.40765 Hz   32.641 kHz   32.930 kHz
V amptd(1)        1.81 V       1.805 V       10 mV          1.80 V       1.83 V
```

Figure 6 SleepClk



File
Control
Setup
Measure
Analyze
Utilities
Help
3:33 PM
On
200 mV/div
On
On
On
20.0 ns/div
0.0 s
524 mV
More (1 of 2)
Clear All
Measurements
Markers
Scales

```
Acquisition is stopped.
2.00 GSa/s
```

```
                  current      mean         std dev   min          max
Frequency(1•)     38.447 MHz   38.447 MHz   0.0 Hz    38.447 MHz   38.447 MHz
V amptd(1)        691 mV       691 mV       0.0 V     691 mV       691 mV
```

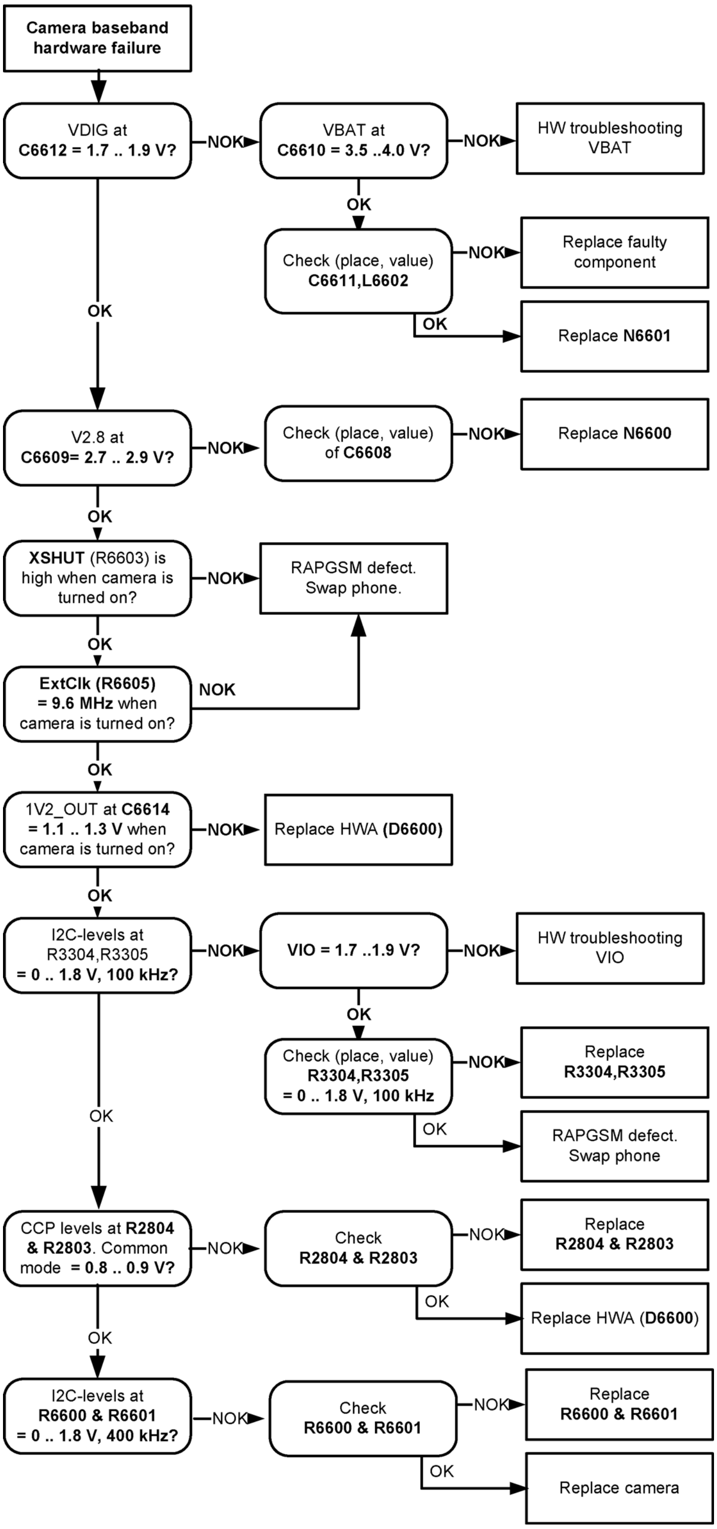
Figure 7 SysClk

Interface troubleshooting

Camera failure

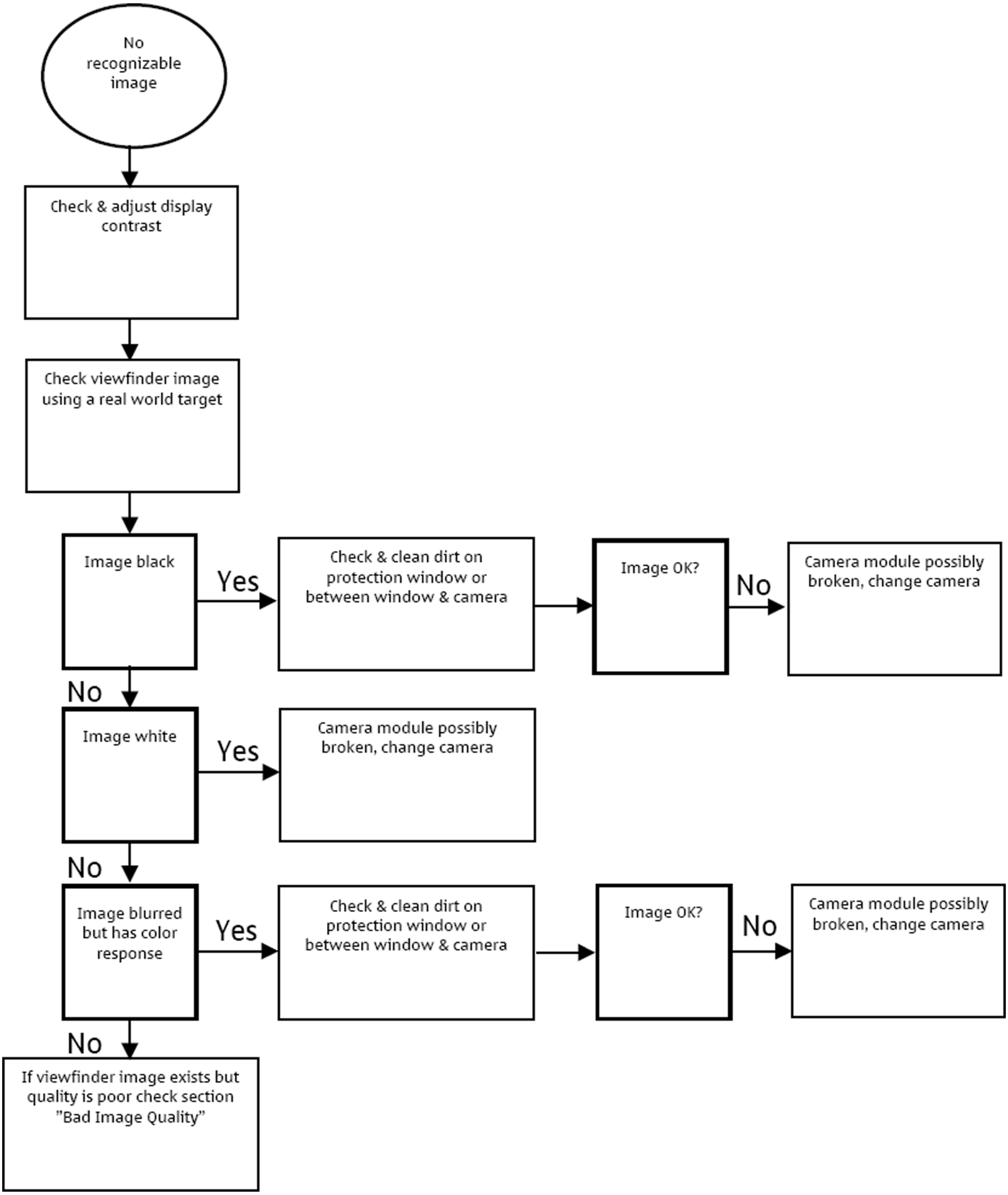
Camera baseband hardware failure troubleshooting

Troubleshooting flow


Camera baseband hardware failure
VDIG at C6612 = 1.7 .. 1.9 V?
NOK
VBAT at C6610 = 3.5 ..4.0 V?
NOK
HW troubleshooting VBAT
OK
Check (place, value) C6611,L6602
NOK
Replace faulty component
OK
Replace N6601
OK
V2.8 at C6609= 2.7 .. 2.9 V?
NOK
Check (place, value) of C6608
NOK
Replace N6600
OK
XSHUT (R6603) is high when camera is turned on?
NOK
RAPGSM defect. Swap phone.
OK
ExtClk (R6605) = 9.6 MHz when camera is turned on?
NOK
OK
1V2_OUT at C6614 = 1.1 .. 1.3 V when camera is turned on?
NOK
Replace HWA (D6600)
OK
I2C-levels at R3304,R3305 = 0 .. 1.8 V, 100 kHz?
NOK
VIO = 1.7 ..1.9 V?
NOK
HW troubleshooting VIO
OK
Check (place, value) R3304,R3305 = 0 .. 1.8 V, 100 kHz
NOK
Replace R3304,R3305
OK
RAPGSM defect. Swap phone
OK
CCP levels at R2804 & R2803. Common mode = 0.8 .. 0.9 V?
NOK
Check R2804 & R2803
NOK
Replace R2804 & R2803
OK
Replace HWA (D6600)
OK
I2C-levels at R6600 & R6601 = 0 .. 1.8 V, 400 kHz?
NOK
Check R6600 & R6601
NOK
Replace R6600 & R6601
OK
Replace camera

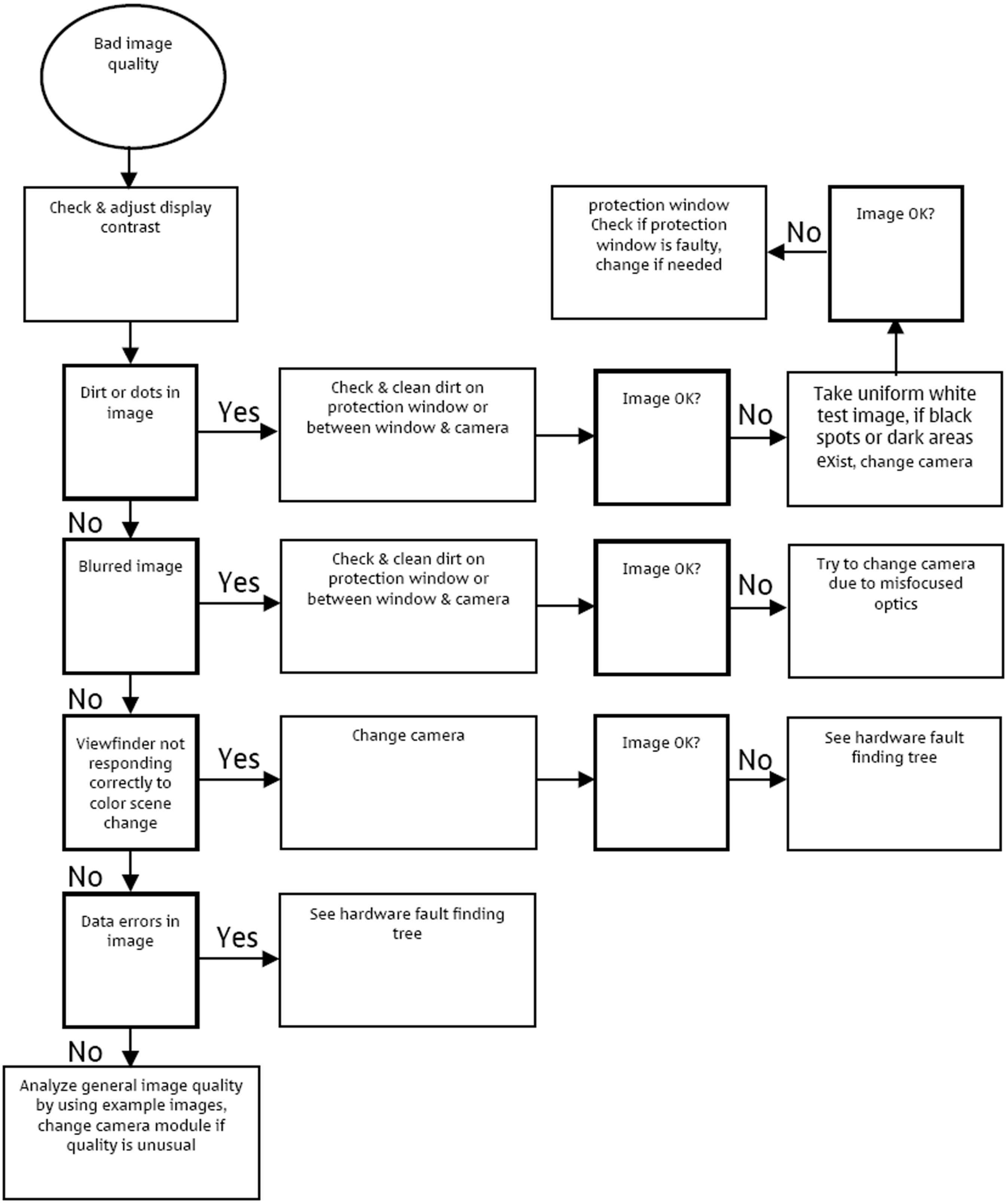
Camera viewfinder troubleshooting

Troubleshooting flow


No recognizable image
Check & adjust display contrast
Check viewfinder image using a real world target
Image black
Yes
Check & clean dirt on protection window or between window & camera
Image OK?
No
Camera module possibly broken, change camera
No
Image white
Yes
Camera module possibly broken, change camera
No
Image blurred but has color response
Yes
Check & clean dirt on protection window or between window & camera
Image OK?
No
Camera module possibly broken, change camera
No
If viewfinder image exists but quality is poor check section "Bad Image Quality"

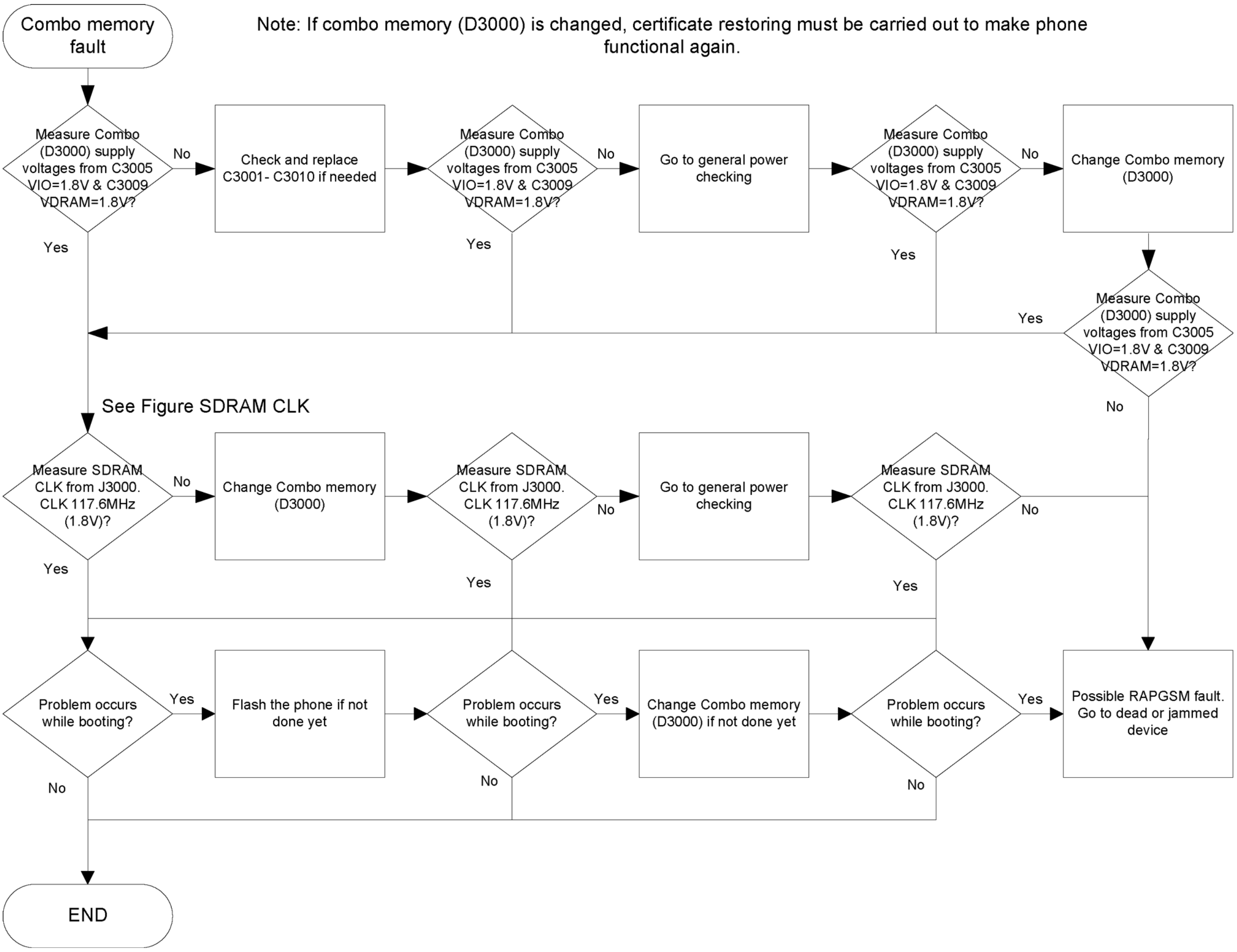
Camera: Bad image quality troubleshooting

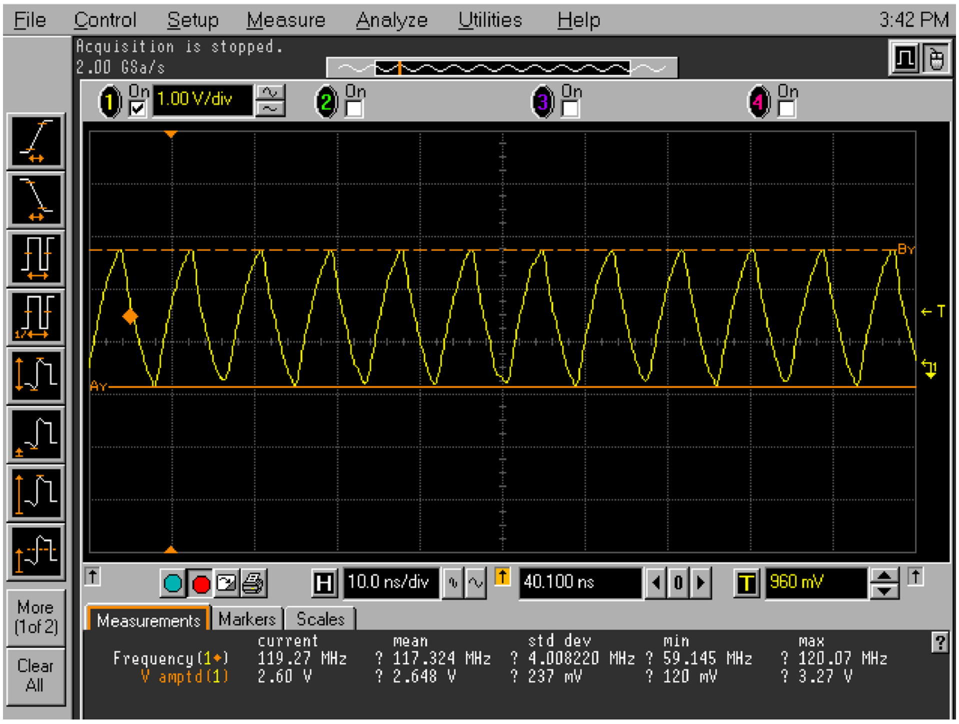
Troubleshooting flow


Bad image quality
Check & adjust display contrast
Dirt or dots in image
Yes
Check & clean dirt on protection window or between window & camera
Image OK?
No
Take uniform white test image, if black spots or dark areas exist, change camera
Image OK?
No
protection window Check if protection window is faulty, change if needed
No
Blurred image
Yes
Check & clean dirt on protection window or between window & camera
Image OK?
No
Try to change camera due to misfocused optics
No
Viewfinder not responding correctly to color scene change
Yes
Change camera
Image OK?
No
See hardware fault finding tree
No
Data errors in image
Yes
See hardware fault finding tree
No
Analyze general image quality by using example images, change camera module if quality is unusual

COMBO memory troubleshooting

Troubleshooting flow


Combo memory fault
Note: If combo memory (D3000) is changed, certificate restoring must be carried out to make phone functional again.
Measure Combo (D3000) supply voltages from C3005 VIO=1.8V & C3009 VDRAM=1.8V?
No
Check and replace C3001- C3010 if needed
Measure Combo (D3000) supply voltages from C3005 VIO=1.8V & C3009 VDRAM=1.8V?
No
Go to general power checking
Measure Combo (D3000) supply voltages from C3005 VIO=1.8V & C3009 VDRAM=1.8V?
No
Change Combo memory (D3000)
Yes
Yes
Yes
Measure Combo (D3000) supply voltages from C3005 VIO=1.8V & C3009 VDRAM=1.8V?
Yes
No
See Figure SDRAM CLK
Measure SDRAM CLK from J3000. CLK 117.6MHz (1.8V)?
No
Change Combo memory (D3000)
Measure SDRAM CLK from J3000. CLK 117.6MHz (1.8V)?
No
Go to general power checking
Measure SDRAM CLK from J3000. CLK 117.6MHz (1.8V)?
No
Yes
Yes
Yes
Problem occurs while booting?
Yes
Flash the phone if not done yet
Problem occurs while booting?
Yes
Change Combo memory (D3000) if not done yet
Problem occurs while booting?
Yes
Possible RAPGSM fault. Go to dead or jammed device
No
No
No
END

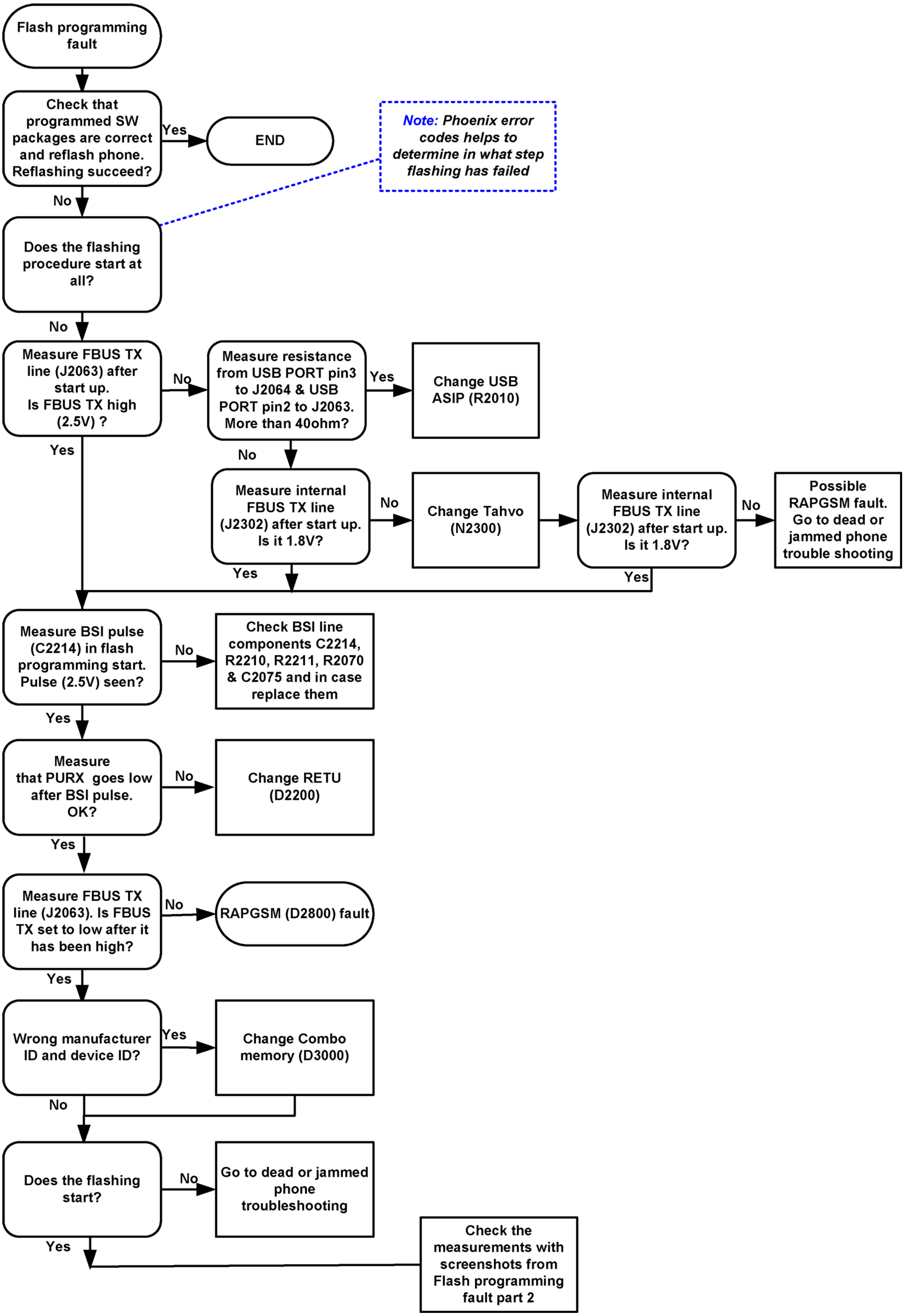

File
Control
Setup
Measure
Analyze
Utilities
Help
3:42 PM
Acquisition is stopped.
2.00 GSa/s
1
On
1.00 V/div
2
On
3
On
4
On
BY
AY
T
More (1of 2)
Clear All
H
10.0 ns/div
40.100 ns
0
T
960 mV
Measurements
Markers
Scales
?

```
                  current       mean           std dev          min            max
Frequency(1+)    119.27 MHz  ? 117.324 MHz  ? 4.008220 MHz  ? 59.145 MHz  ? 120.07 MHz
  V amptd(1)     2.60 V      ? 2.648 V      ? 237 mV        ? 120 mV      ? 3.27 V
```

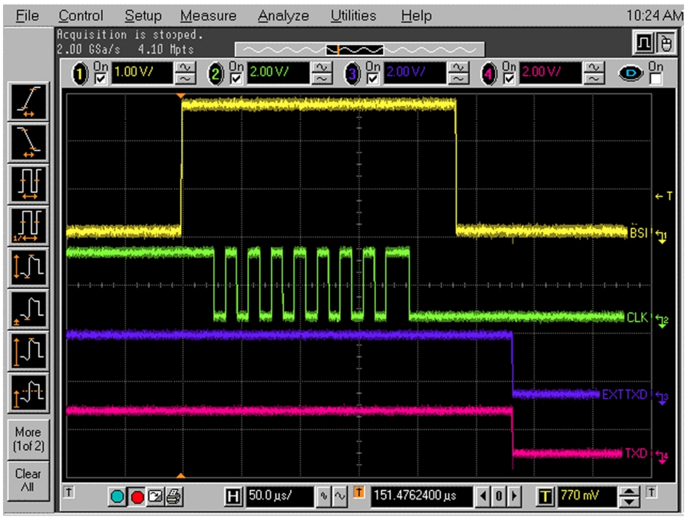
Figure 8 SDRAM CLK

Flash programming fault troubleshooting

Part 1


Flash programming fault
Check that programmed SW packages are correct and reflash phone. Reflashing succeed?
Yes
END
Note: Phoenix error codes helps to determine in what step flashing has failed
No
Does the flashing procedure start at all?
No
Measure FBUS TX line (J2063) after start up. Is FBUS TX high (2.5V) ?
No
Measure resistance from USB PORT pin3 to J2064 & USB PORT pin2 to J2063. More than 40ohm?
Yes
Change USB ASIP (R2010)
Yes
No
Measure internal FBUS TX line (J2302) after start up. Is it 1.8V?
No
Change Tahvo (N2300)
Measure internal FBUS TX line (J2302) after start up. Is it 1.8V?
No
Possible RAPGSM fault. Go to dead or jammed phone trouble shooting
Yes
Yes
Measure BSI pulse (C2214) in flash programming start. Pulse (2.5V) seen?
No
Check BSI line components C2214, R2210, R2211, R2070 & C2075 and in case replace them
Yes
Measure that PURX goes low after BSI pulse. OK?
No
Change RETU (D2200)
Yes
Measure FBUS TX line (J2063). Is FBUS TX set to low after it has been high?
No
RAPGSM (D2800) fault
Yes
Wrong manufacturer ID and device ID?
Yes
Change Combo memory (D3000)
No
Does the flashing start?
No
Go to dead or jammed phone troubleshooting
Yes
Check the measurements with screenshots from Flash programming fault part 2

Part 2

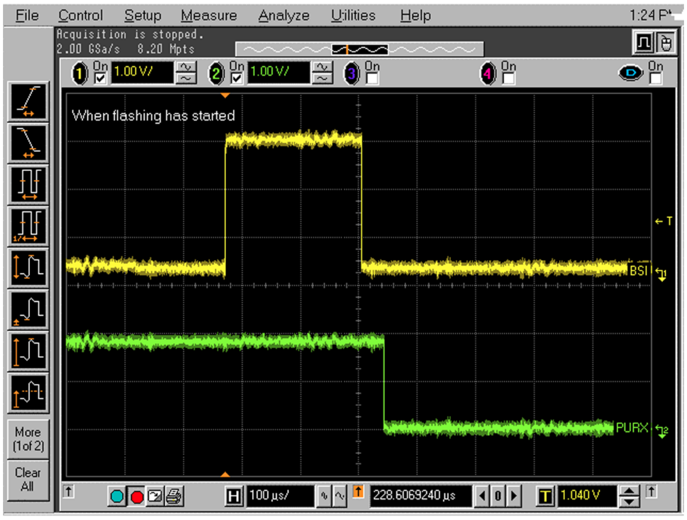


Acquisition is stopped.
2.00 GSa/s 4.10 Mpts

File
Control
Setup
Measure
Analyze
Utilities
Help
10:24 AM
1.00 V/
2.00 V/
2.00 V/
2.00 V/
BSI
CLK
EXTTXD
TXD
More (1 of 2)
Clear All
50.0 µs/
151.4762400 µs
770 mV

Figure 9 Flashing pic 1. Take single trig measurement for the rise of the BSI signal.

Saved: 05 JUL 2004 13:24:19



Acquisition is stopped.
2.00 GSa/s 8.20 Mpts

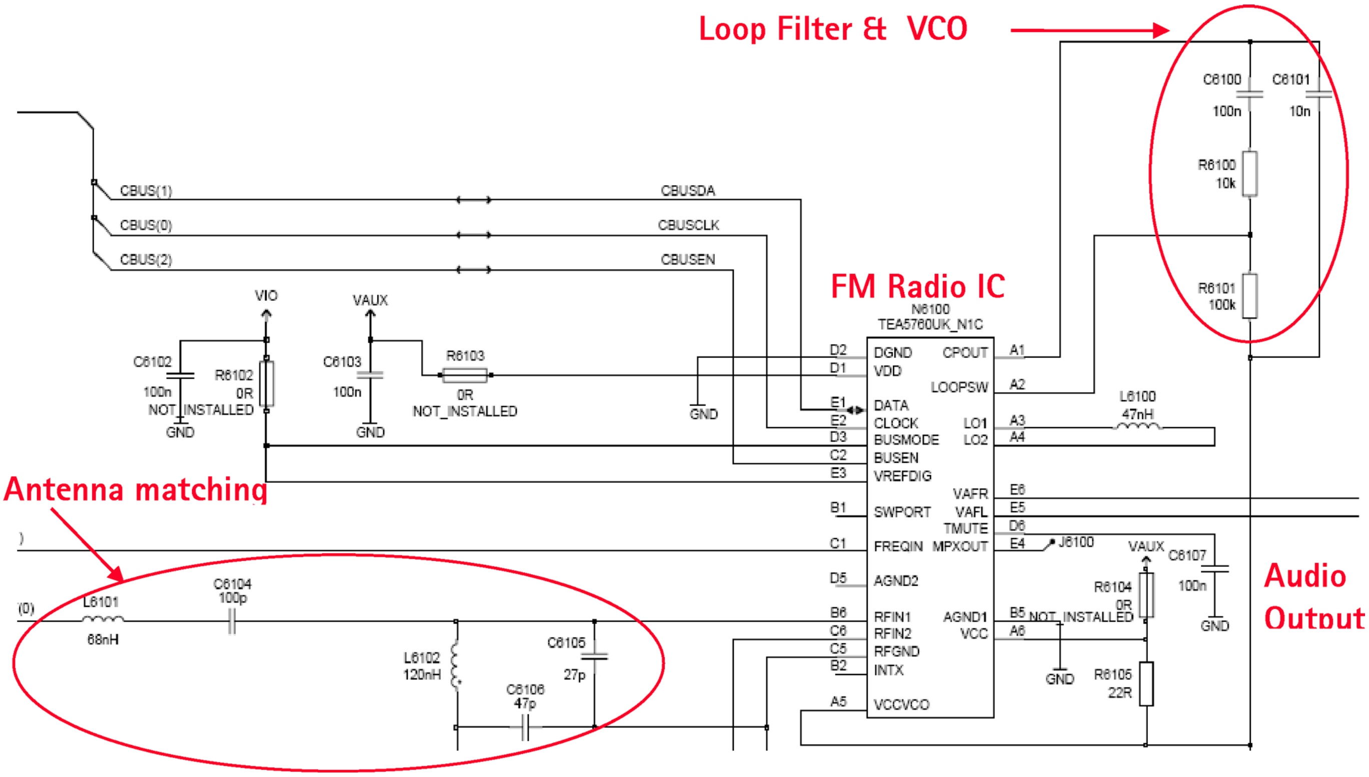
When flashing has started

File
Control
Setup
Measure
Analyze
Utilities
Help
1:24 PM
1.00 V/
1.00 V/
BSI
PURX
More (1 of 2)
Clear All
100 µs/
228.6069240 µs
1.040 V

Figure 10 Flashing pic 2. Take single trig measurement for the rise of the BSI signal.

FM radio troubleshooting

FM radio schematic


Loop Filter & VCO
FM Radio IC
N6100
TEA5760UK_N1C
Antenna matching
Audio Output
CBUS(1)
CBUS(0)
CBUS(2)
CBUSDA
CBUSCLK
CBUSEN
VIO
VAUX
C6102
100n
R6102
0R
NOT_INSTALLED
GND
C6103
100n
R6103
0R
NOT_INSTALLED
DGND
VDD
DATA
CLOCK
BUSMODE
BUSEN
VREFDIG
SWPORT
FREQIN
AGND2
RFIN1
RFIN2
RFGND
INTX
VCCVCO
CPOUT
LOOPSW
LO1
LO2
VAFR
VAFL
TMUTE
MPXOUT
AGND1
VCC
C6100
100n
C6101
10n
R6100
10k
R6101
100k
L6100
47nH
J6100
C6107
100n
R6104
0R
NOT_INSTALLED
R6105
22R
L6101
68nH
C6104
100p
L6102
120nH
C6105
27p
C6106
47p

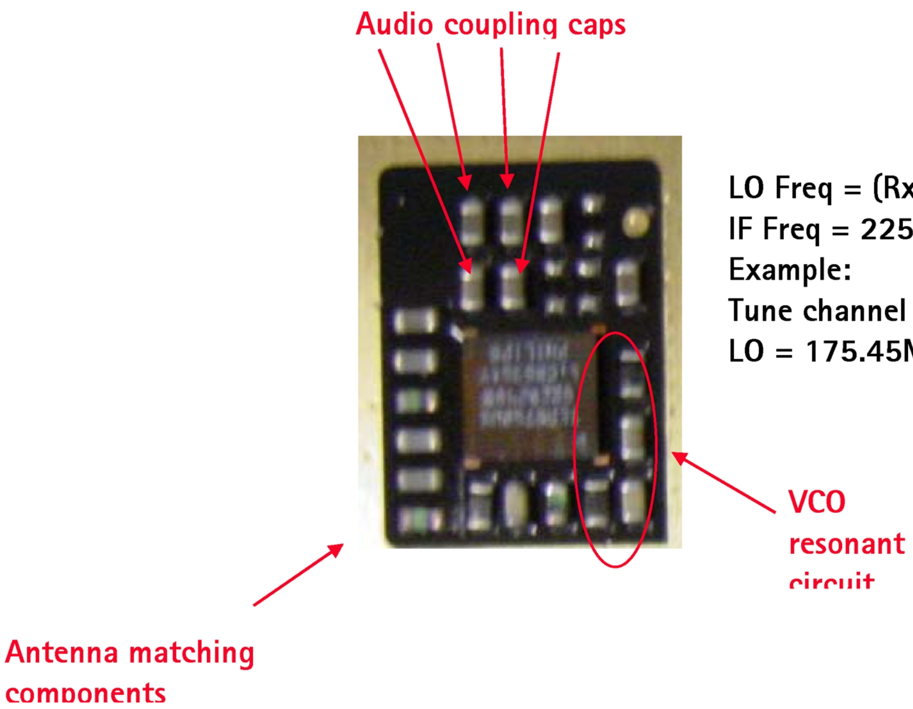
FM radio testing with headset

Steps

1. Connect the micro USB AV adapter to the headset (i.e. AD-55 with Nokia AV headset).
2. Select **Radio** from the phone user interface **Menu**, then **Media**.
3. In a FM Radio broadcast coverage area, set a local radio channel by scanning automatically through the **Automatic tuning** option. (Scanning up & down the channels by pressing the UP & DOWN key respectively).
4. If no channel could be found, inspect all the components in the FM Radio circuitry. If no problem found visually, check the existence of the LO (by radiated pickup) near the VCO part of the FM Radio IC. If no LO found, replace the FM Radio IC.
5. Listen for sound out of the Micro USB headset.

   If there is a signal present, continue on next slide. If there is no static sound present, inspect all FM Radio circuits on the PCB and refer to the baseband section on audio troubleshooting.

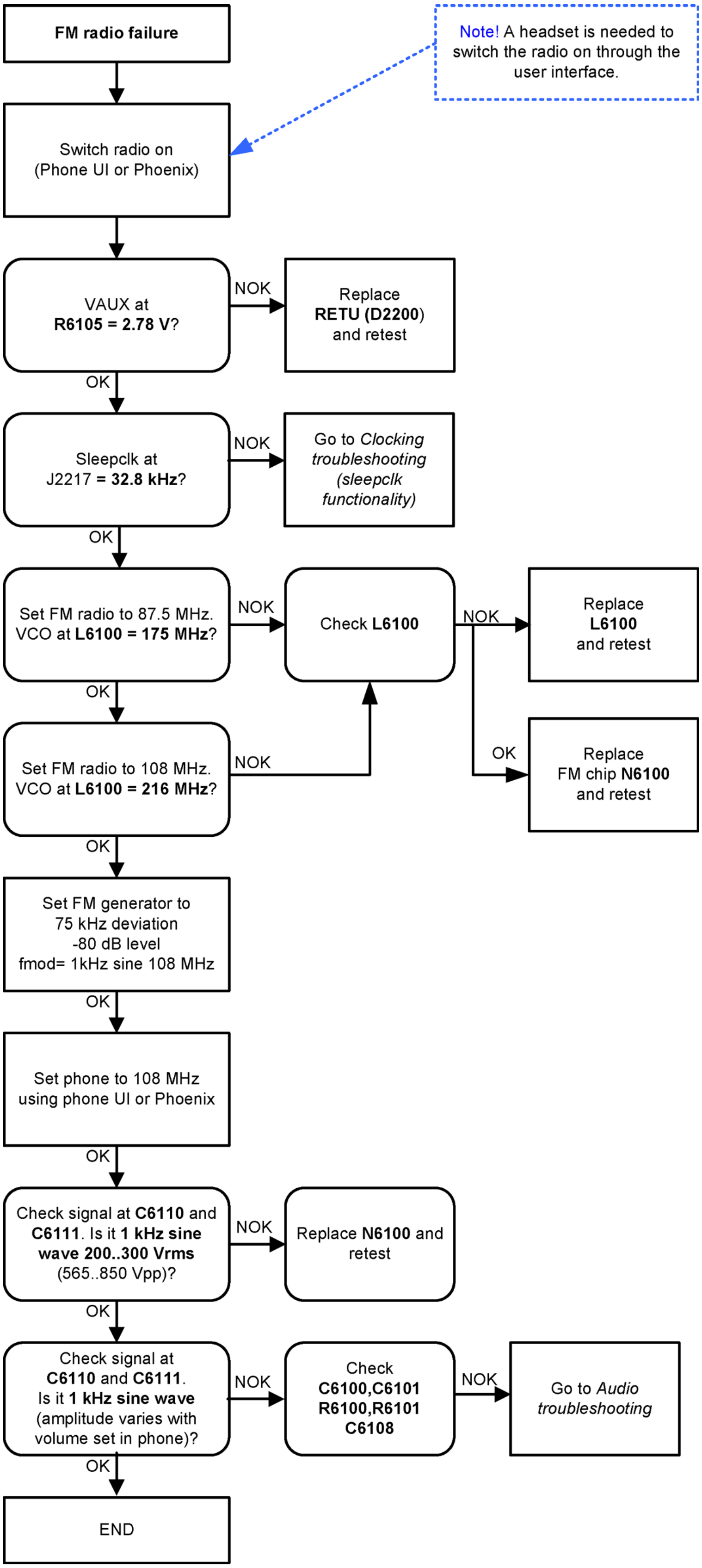
FM radio component layout


Audio coupling caps
VCO resonant circuit
Antenna matching components

LO Freq = (Rx Freq+IF Freq) x 2
IF Freq = 225kHz
Example:
Tune channel = (87.5+0.225)*2 MHz
LO = 175.45MHz

FM radio troubleshooting

Troubleshooting flow


FM radio failure
Note! A headset is needed to switch the radio on through the user interface.
Switch radio on (Phone UI or Phoenix)
VAUX at R6105 = 2.78 V?
NOK
Replace RETU (D2200) and retest
OK
Sleepclk at J2217 = 32.8 kHz?
NOK
Go to Clocking troubleshooting (sleepclk functionality)
OK
Set FM radio to 87.5 MHz. VCO at L6100 = 175 MHz?
NOK
Check L6100
NOK
Replace L6100 and retest
OK
Replace FM chip N6100 and retest
OK
Set FM radio to 108 MHz. VCO at L6100 = 216 MHz?
NOK
OK
Set FM generator to 75 kHz deviation -80 dB level fmod= 1kHz sine 108 MHz
OK
Set phone to 108 MHz using phone UI or Phoenix
OK
Check signal at C6110 and C6111. Is it 1 kHz sine wave 200..300 Vrms (565..850 Vpp)?
NOK
Replace N6100 and retest
OK
Check signal at C6110 and C6111. Is it 1 kHz sine wave (amplitude varies with volume set in phone)?
NOK
Check C6100,C6101 R6100,R6101 C6108
NOK
Go to Audio troubleshooting
OK
END

User interface troubleshooting

Display module troubleshooting

General instructions for display troubleshooting

Context

- The display is in a normal mode when the phone is in active use.
- Display is in a partial idle mode when the phone is in the screen saver mode.
- The operating modes of the display can be controlled with the help of *Phoenix*.

Table 11 Display module troubleshooting cases

Display blank	There is no image on the display. The display looks the same when the phone is on as it does when the phone is off. The backlight can be on in some cases.
Image on the display not correct	Image on the display can be corrupted or a part of the image can be missing. If a part of the image is missing, change the display module. If the image is otherwise corrupted, follow the appropriate troubleshooting diagram.
Backlight dim or not working at all	Backlight LED components are inside the display module. Backlight failure can also be in the connector or in the backlight power source in the main engine of the phone. This means that in case the display is working (image OK), the backlight is faulty.
Visual defects (pixel)	Pixel defects can be checked by controlling the display with Phoenix. Use both colours, black and white, on a full screen. The display may have some random pixel defects that are acceptable for this type of display. The criteria when pixel defects are regarded as a display failure, resulting in a replacement of the display, are presented the following table.

Table 12 Pixel defects

Item		White dot defect				Black dot defect	Total
1	Defect counts	R	G	B	White Dot Total	1	1
		1	1	1	1		
2	Combined defect counts	Not allowed. Two single dot defects that are within 5 mm of each other should be interpreted as combined dot defect.					

Steps

1. Verify with a working display that the fault is not on the display module itself.

   The display module cannot be repaired.

2. Check that the cellular engine is working normally.

   i To check the functionality, connect the phone to a docking station.

   ii Start *Phoenix* service software.

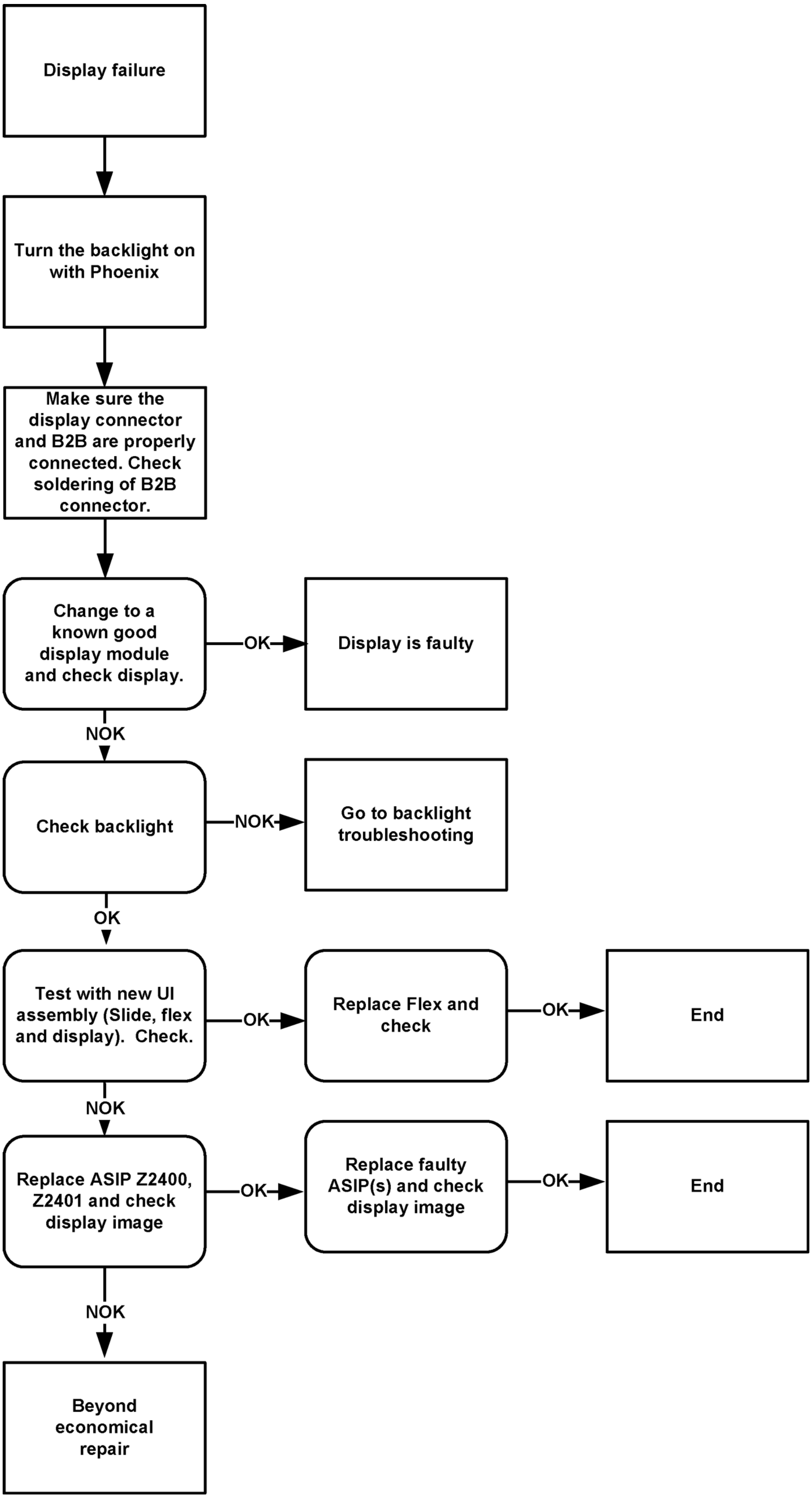
   iii Read the phone information to check that also the application engine is functioning normally (you should be able to read the APE ID).

3. Proceed to the display troubleshooting flowcharts.

   Use the **Display Test** tool in *Phoenix* to find the detailed fault mode.

Display troubleshooting

Troubleshooting flow

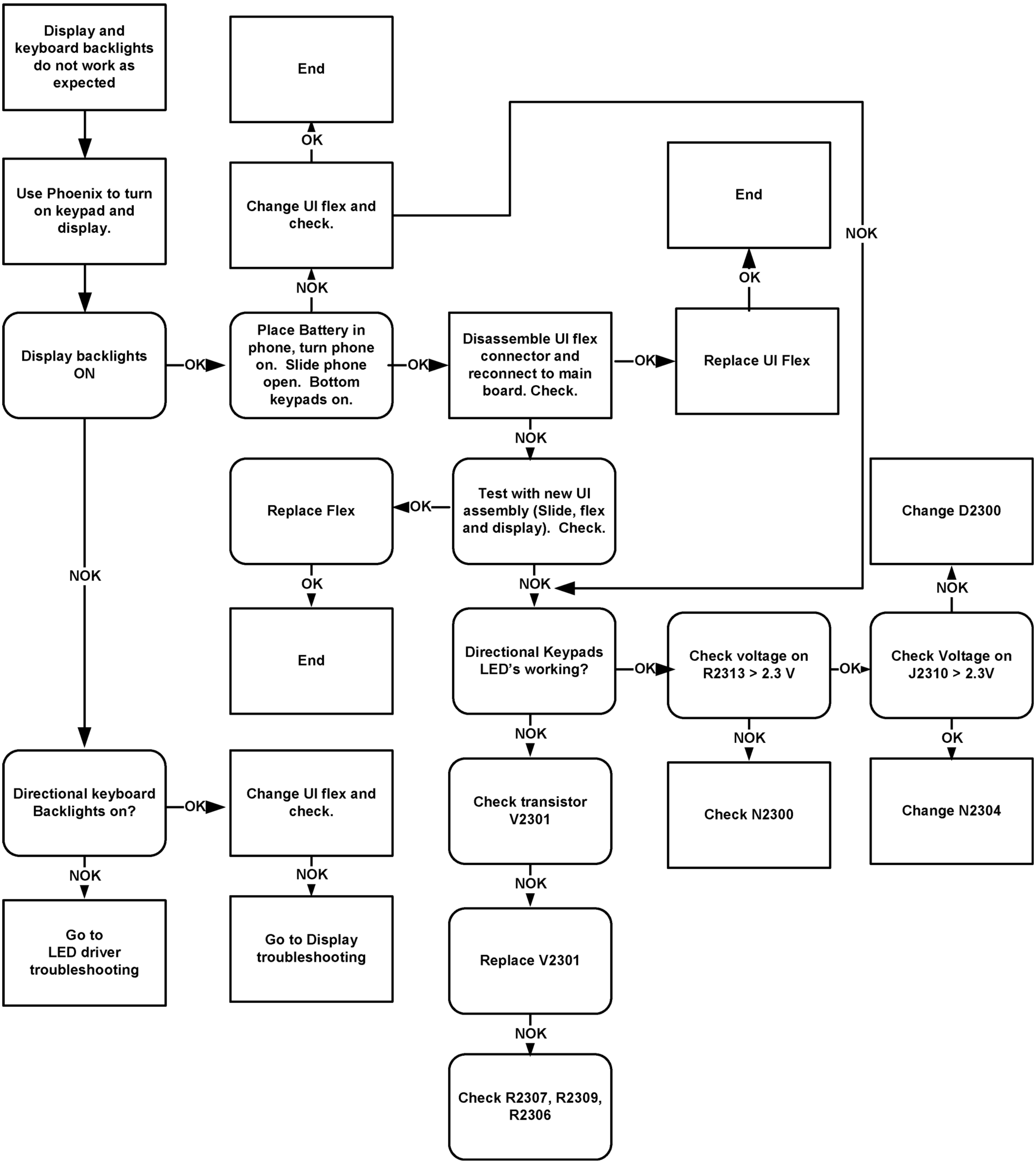

Display failure
Turn the backlight on with Phoenix
Make sure the display connector and B2B are properly connected. Check soldering of B2B connector.
Change to a known good display module and check display.
OK
Display is faulty
NOK
Check backlight
NOK
Go to backlight troubleshooting
OK
Test with new UI assembly (Slide, flex and display). Check.
OK
Replace Flex and check
OK
End
NOK
Replace ASIP Z2400, Z2401 and check display image
OK
Replace faulty ASIP(s) and check display image
OK
End
NOK
Beyond economical repair

Backlight troubleshooting

Context

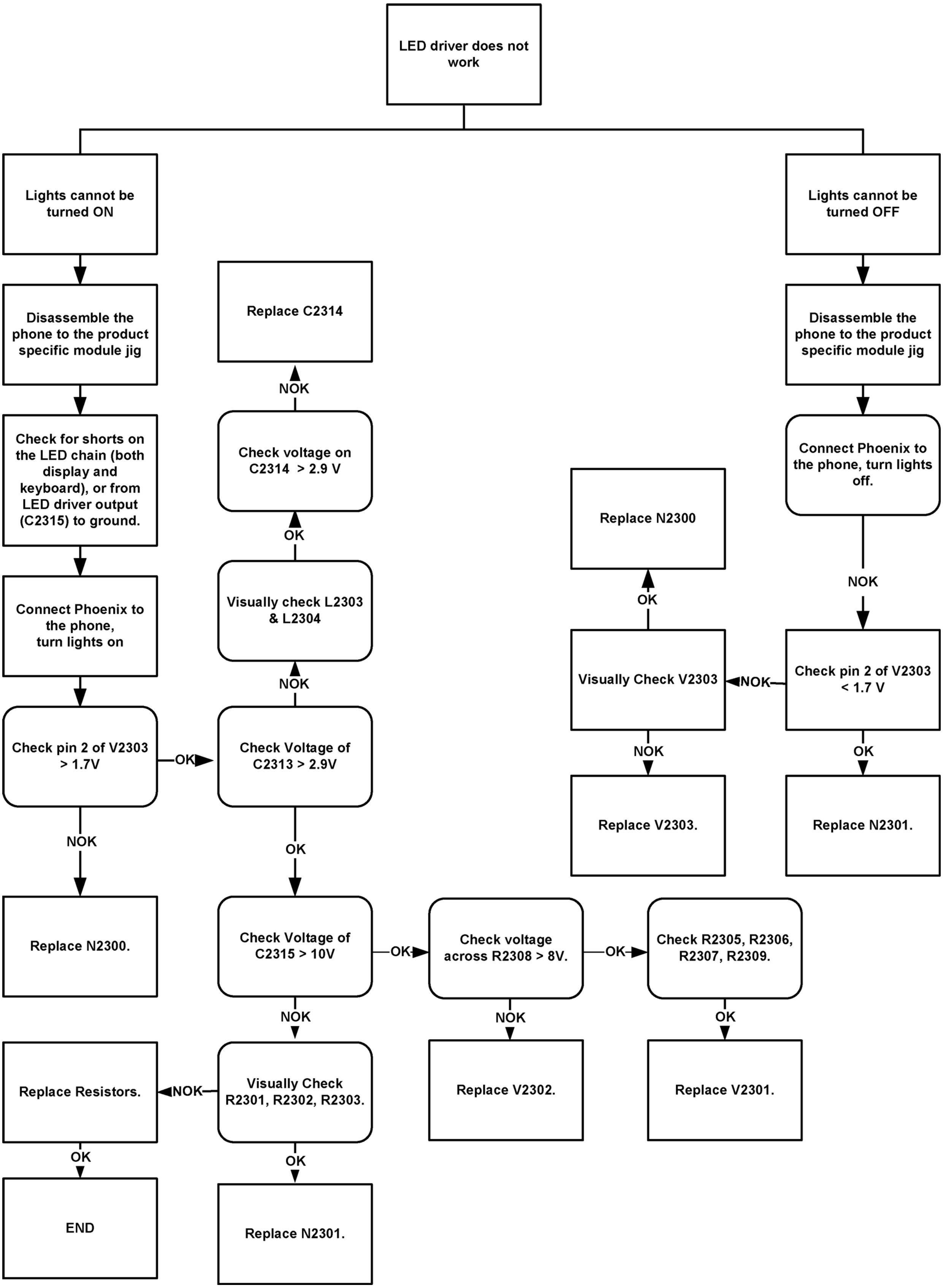
The device has one LED driver that provides current for both display and keyboard backlights. Brightness can be adjusted manually. It affects both display and keypad. Keyboard backlights can be turned ON/OFF separately but not without switching on the display lights.

Display and keyboard backlight troubleshooting


Display and keyboard backlights do not work as expected
Use Phoenix to turn on keypad and display.
Display backlights ON
OK
Place Battery in phone, turn phone on. Slide phone open. Bottom keypads on.
NOK
Change UI flex and check.
OK
End
NOK
OK
Disassemble UI flex connector and reconnect to main board. Check.
OK
Replace UI Flex
OK
End
NOK
Test with new UI assembly (Slide, flex and display). Check.
OK
Replace Flex
OK
End
NOK
Directional Keypads LED's working?
OK
Check voltage on R2313 > 2.3 V
OK
Check Voltage on J2310 > 2.3V
NOK
Change D2300
OK
Change N2304
NOK
Check N2300
NOK
Check transistor V2301
NOK
Replace V2301
NOK
Check R2307, R2309, R2306
NOK
Directional keyboard Backlights on?
OK
Change UI flex and check.
NOK
Go to Display troubleshooting
NOK
Go to LED driver troubleshooting

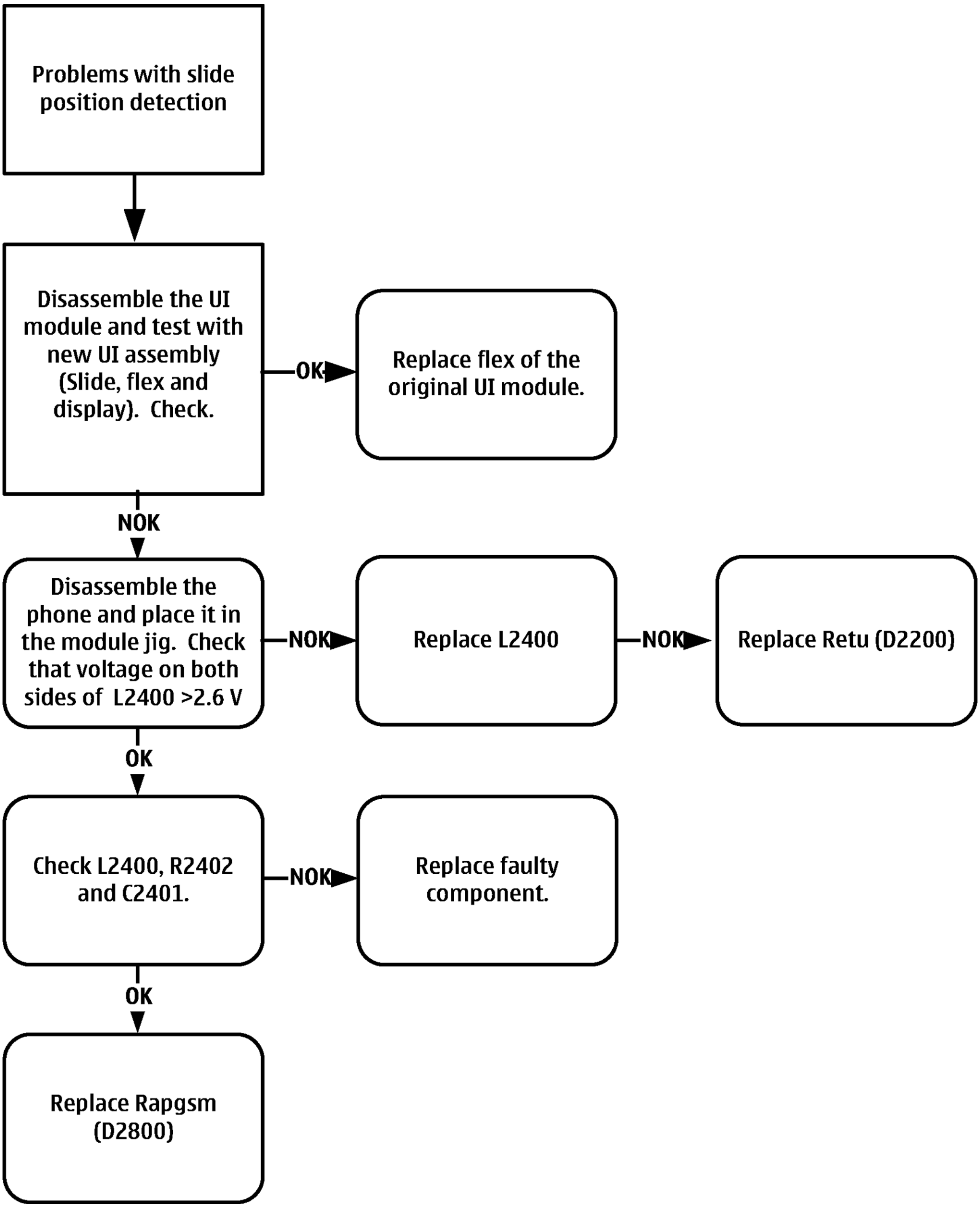
LED driver troubleshooting

Troubleshooting flow


LED driver does not work
Lights cannot be turned ON
Lights cannot be turned OFF
Disassemble the phone to the product specific module jig
Replace C2314
Disassemble the phone to the product specific module jig
NOK
Check for shorts on the LED chain (both display and keyboard), or from LED driver output (C2315) to ground.
Check voltage on C2314 > 2.9 V
Connect Phoenix to the phone, turn lights off.
Replace N2300
OK
Visually check L2303 & L2304
NOK
Connect Phoenix to the phone, turn lights on
OK
NOK
Visually Check V2303
NOK
Check pin 2 of V2303 < 1.7 V
Check pin 2 of V2303 > 1.7V
OK
Check Voltage of C2313 > 2.9V
NOK
OK
Replace V2303.
Replace N2301.
NOK
OK
Replace N2300.
Check Voltage of C2315 > 10V
OK
Check voltage across R2308 > 8V.
OK
Check R2305, R2306, R2307, R2309.
NOK
NOK
OK
Replace Resistors.
NOK
Visually Check R2301, R2302, R2303.
Replace V2302.
Replace V2301.
OK
OK
END
Replace N2301.

MR sensor (switch) troubleshooting

Troubleshooting flow


Problems with slide position detection
Disassemble the UI module and test with new UI assembly (Slide, flex and display). Check.
OK
Replace flex of the original UI module.
NOK
Disassemble the phone and place it in the module jig. Check that voltage on both sides of L2400 >2.6 V
NOK
Replace L2400
NOK
Replace Retu (D2200)
OK
Check L2400, R2402 and C2401.
NOK
Replace faulty component.
OK
Replace Rapgsm (D2800)

■ Audio troubleshooting

Audio troubleshooting test instructions

Differential external earpiece and internal earpiece outputs can be measured either with a single-ended or a differential probe.

When measuring with a single-ended probe each output is measured against the ground.

Internal handsfree output is measured using a current probe, if a special low-pass filter designed for measuring a digital amplifier is not available. Note also that when using a current probe, the input signal frequency must be set to 2kHz.

The input signal for each loop test can be either single-ended or differential.

Required equipment

The following equipment is needed for the tests:

- Oscilloscope
- Function generator (sine waveform)
- Current probe (Internal handsfree PWM output measurement)
- Phoenix service software
- Battery voltage 3.7V

Test procedure

Audio can be tested using the Phoenix audio routings option. Three different audio loop paths can be activated:

- External microphone to Internal earpiece
- External microphone to Internal handsfree speaker
- Internal microphone to External earpiece

Each audio loop sets routing from the specified input to the specified output enabling a quick in-out test. Loop path gains are fixed and they cannot be changed using Phoenix. Correct pins and signals for each test are presented in the following table.

Phoenix audio loop tests and test results

The results presented in the table apply when no accessory is connected and battery voltage is set to 3.7V.

Earpiece, internal microphone and speaker are in place during measurement. Applying a headset accessory during measurement causes a significant drop in measured quantities.

The gain values presented in the table apply for a differential output vs. single-ended/differential input.

Loop test	Input terminal	Output terminal	Path gain [dB] (fixed)	Input voltage [mVp-p]	Differential output voltage [mVp-p]	Output DC level [V]	Output current [mA]
External Mic to External Earpiece	MIC2P and GND	D+, D- and GND	-2.9	1000	720	1.2	NA
External Mic to External Earpiece	MIC2P and GND	EAR_P and GND	-4	750	490	1.2	NA
		EAR_N and GND					
External Mic to Internal handsfree	MIC2P and GND	B2101 pads	8.5	920	2520	0	25 mA (calc)

Loop test	Input terminal	Output terminal	Path gain [dB] (fixed)	Input voltage [mVp-p]	Differential output voltage [mVp-p]	Output DC level [V]	Output current [mA]
Internal Mic to External Earpiece	IB2201 (DATA / GND)	D+, D- and GND	22.7	100	1360	1.2	NA

Measurement data

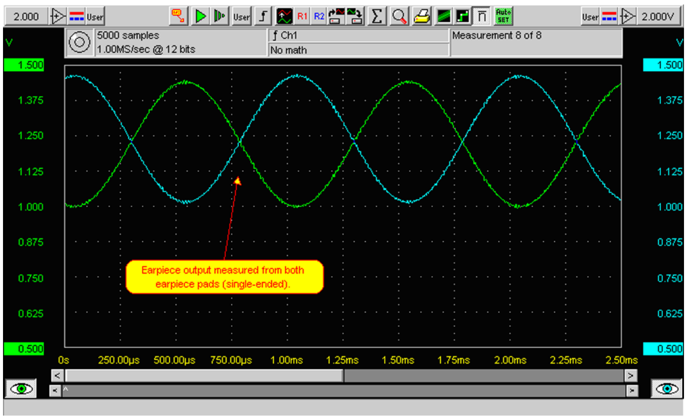

2.000
2.000V
5000 samples
1.00MS/sec @ 12 bits
ƒ Ch1
No math
Measurement 8 of 8
V
1.500
1.375
1.250
1.125
1.000
0.875
0.750
0.625
0.500
0s
250.00µs
500.00µs
750.00µs
1.00ms
1.25ms
1.50ms
1.75ms
2.00ms
2.25ms
2.50ms
Earpiece output measured from both earpiece pads (single-ended).

Figure 11 Single-ended output waveform of the Ext_in_HP_out measurement when earpiece is connected.

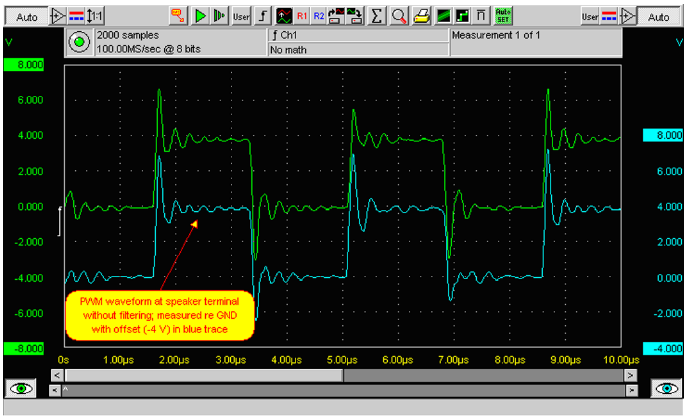

Auto
Auto
2000 samples
100.00MS/sec @ 8 bits
ƒ Ch1
No math
Measurement 1 of 1
V
8.000
6.000
4.000
2.000
0.000
-2.000
-4.000
-6.000
-8.000
0s
1.00µs
2.00µs
3.00µs
4.00µs
5.00µs
6.00µs
7.00µs
8.00µs
9.00µs
10.00µs
PWM waveform at speaker terminal without filtering; measured re GND with offset (-4 V) in blue trace

Figure 12 Differential output waveform of the Ext_in_IHF_out out loop measurement when speaker is connected.

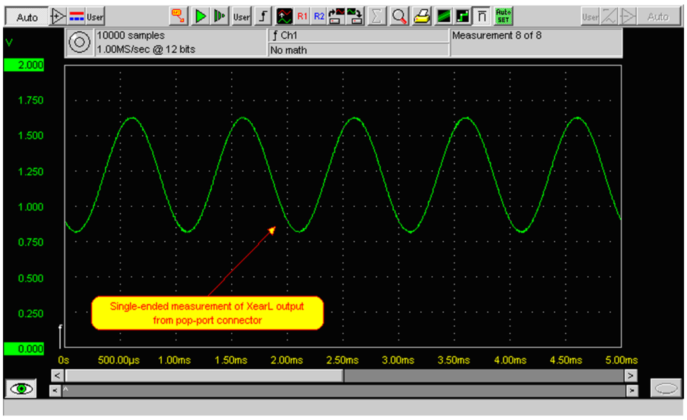
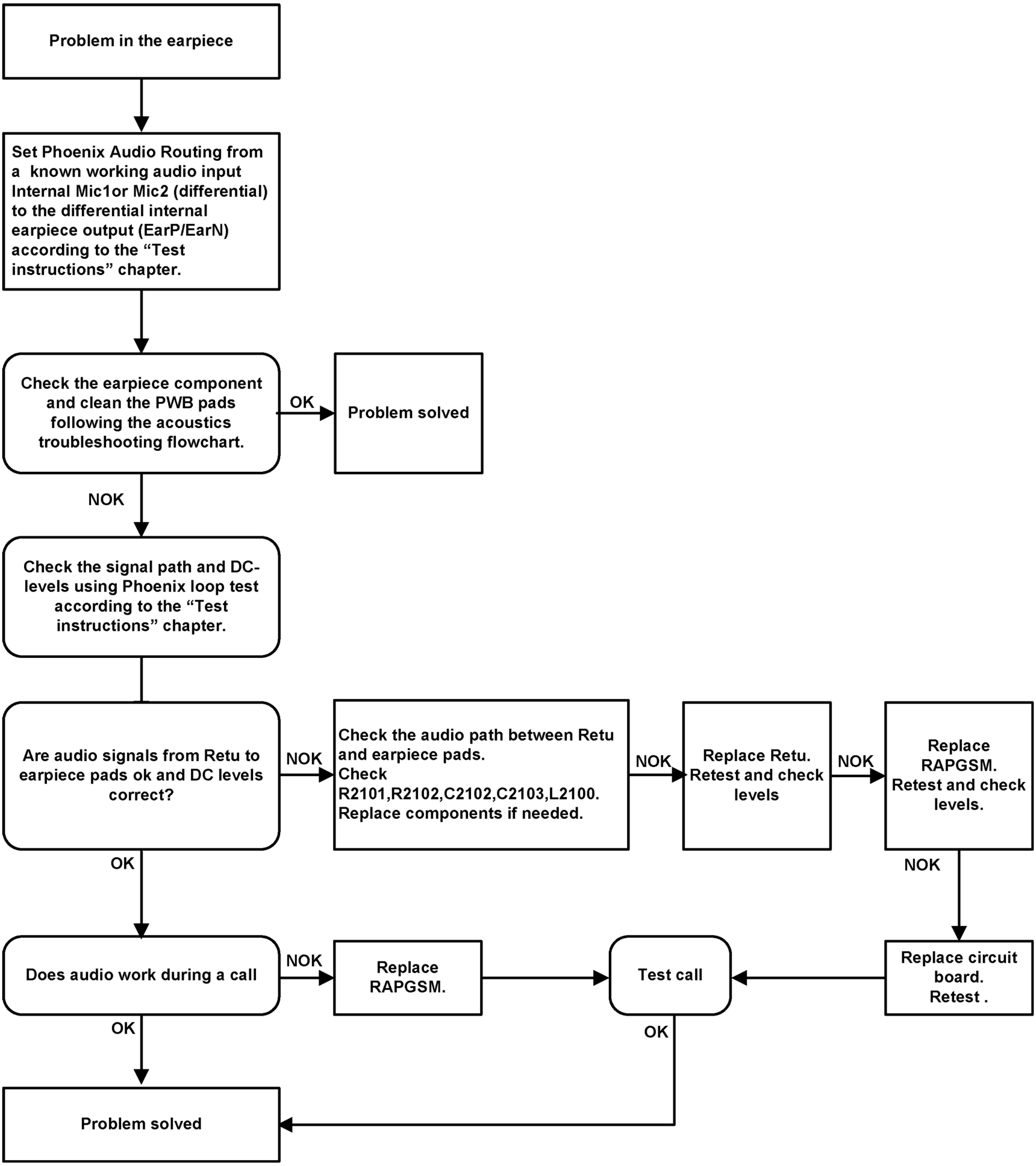

Auto
10000 samples
1.00MS/sec @ 12 bits
ƒ Ch1
No math
Measurement 8 of 8
V
2.000
1.750
1.500
1.250
1.000
0.750
0.500
0.250
0.000
0s
500.00µs
1.00ms
1.50ms
2.00ms
2.50ms
3.00ms
3.50ms
4.00ms
4.50ms
5.00ms
Single-ended measurement of XearL output from pop-port connector

Figure 13 Single-ended output waveform of the HP_in_Ext_out loop when microphone is connected.

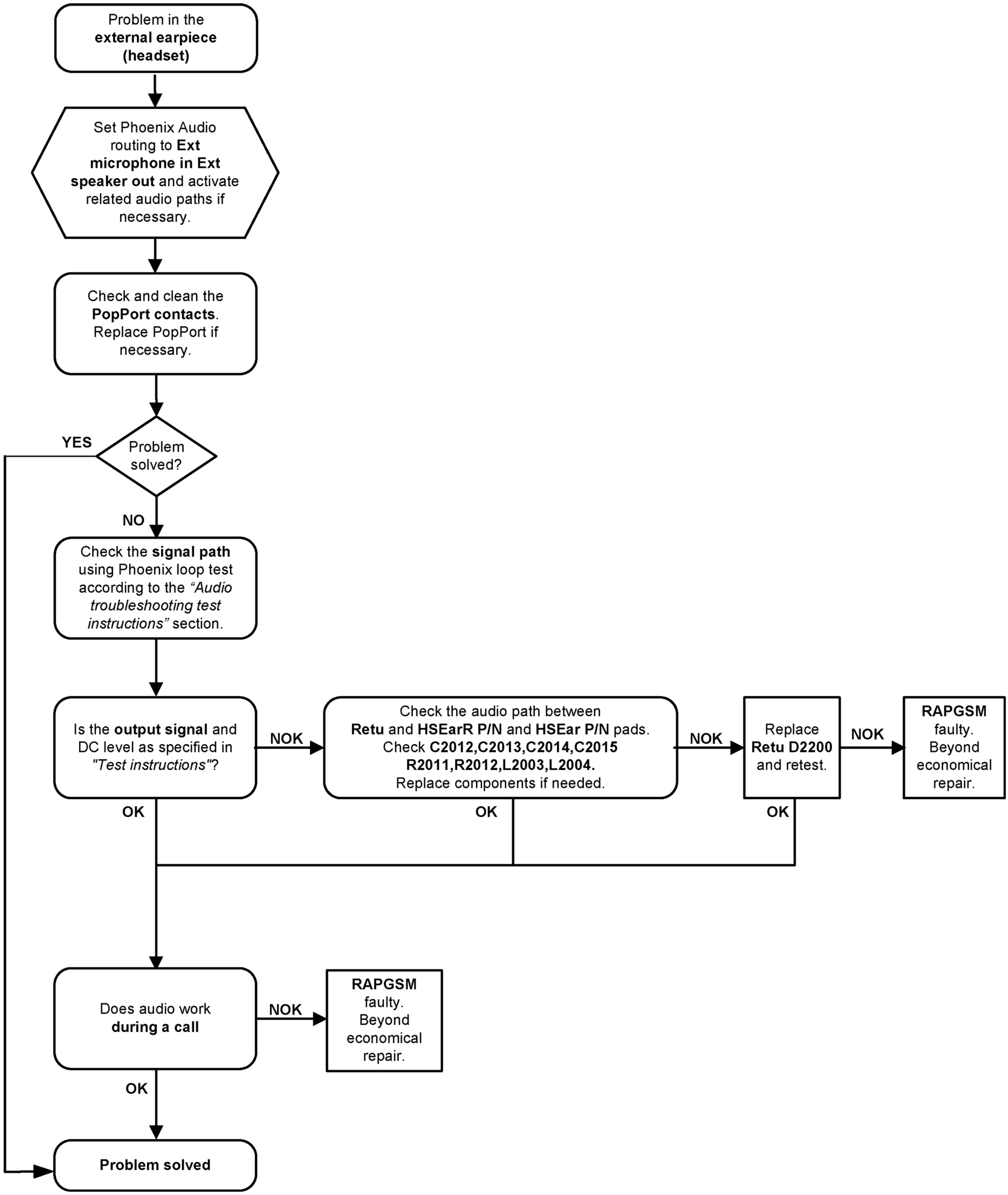
Internal earpiece troubleshooting

Troubleshooting flow


Problem in the earpiece
Set Phoenix Audio Routing from a known working audio input Internal Mic1or Mic2 (differential) to the differential internal earpiece output (EarP/EarN) according to the “Test instructions” chapter.
Check the earpiece component and clean the PWB pads following the acoustics troubleshooting flowchart.
OK
Problem solved
NOK
Check the signal path and DC-levels using Phoenix loop test according to the “Test instructions” chapter.
Are audio signals from Retu to earpiece pads ok and DC levels correct?
NOK
Check the audio path between Retu and earpiece pads. Check R2101,R2102,C2102,C2103,L2100. Replace components if needed.
NOK
Replace Retu. Retest and check levels
NOK
Replace RAPGSM. Retest and check levels.
NOK
OK
Does audio work during a call
NOK
Replace RAPGSM.
Test call
Replace circuit board. Retest .
OK
OK
Problem solved

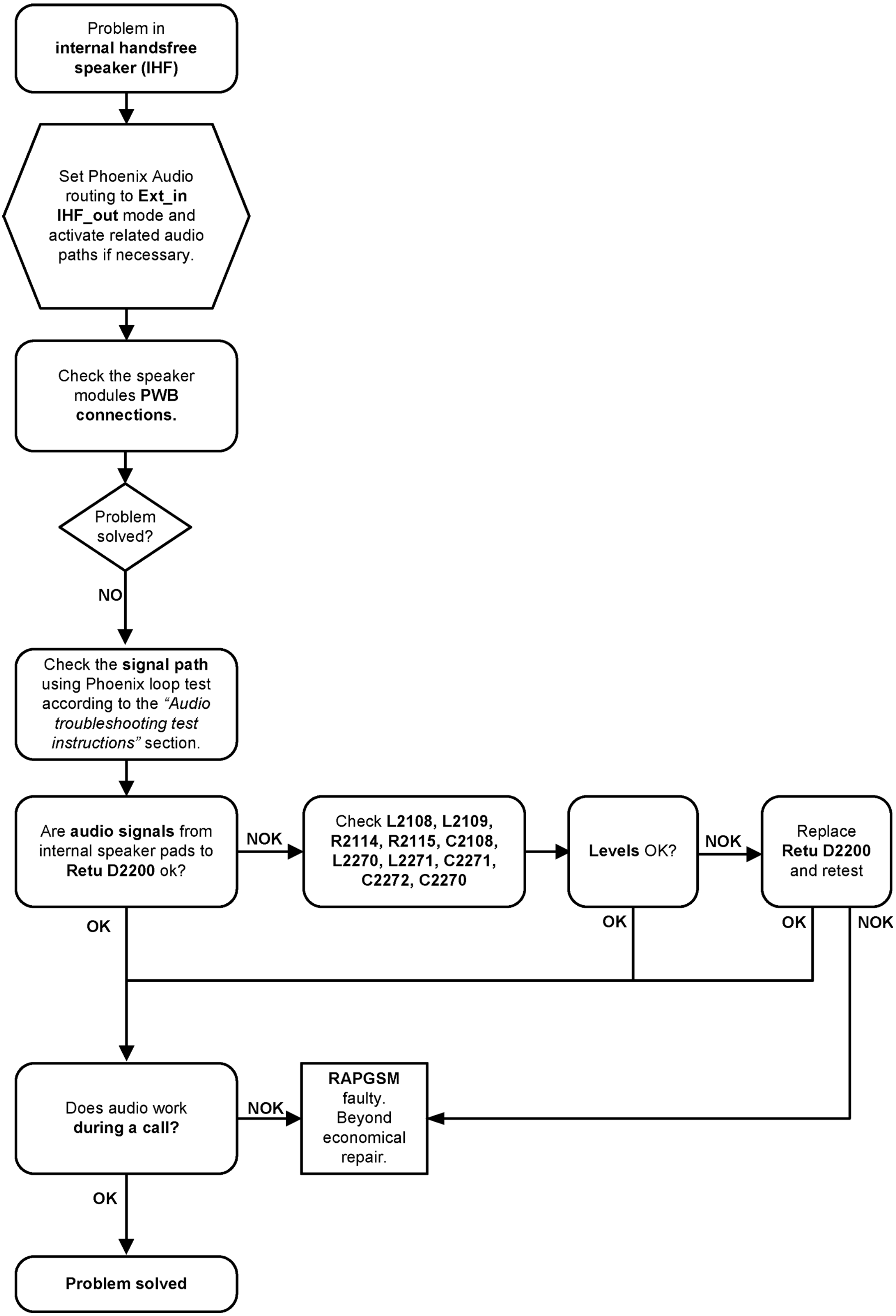
External earpiece troubleshooting

Troubleshooting flow


Problem in the **external earpiece (headset)**
Set Phoenix Audio routing to **Ext microphone in Ext speaker out** and activate related audio paths if necessary.
Check and clean the **PopPort contacts**. Replace PopPort if necessary.
Problem solved?
YES
NO
Check the **signal path** using Phoenix loop test according to the *"Audio troubleshooting test instructions"* section.
Is the **output signal** and DC level as specified in *"Test instructions"*?
NOK
Check the audio path between **Retu** and **HSEarR P/N** and **HSEar P/N** pads. Check **C2012,C2013,C2014,C2015 R2011,R2012,L2003,L2004.** Replace components if needed.
NOK
Replace **Retu D2200** and retest.
NOK
RAPGSM faulty. Beyond economical repair.
OK
OK
OK
Does audio work **during a call**
NOK
RAPGSM faulty. Beyond economical repair.
OK
Problem solved

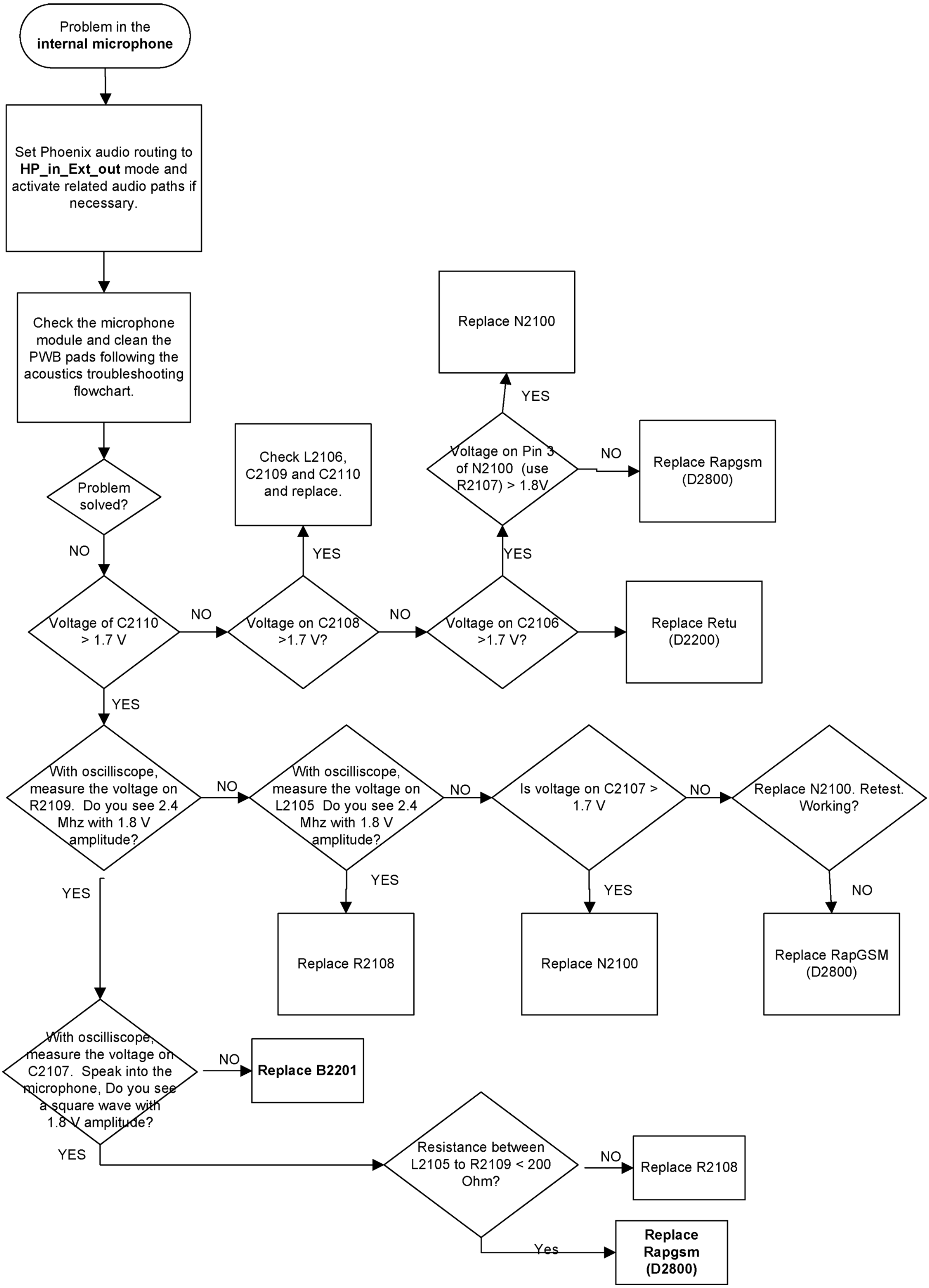
IHF troubleshooting

Troubleshooting flow


Problem in **internal handsfree speaker (IHF)**
Set Phoenix Audio routing to **Ext_in IHF_out** mode and activate related audio paths if necessary.
Check the speaker modules **PWB connections.**
Problem solved?
NO
Check the **signal path** using Phoenix loop test according to the *"Audio troubleshooting test instructions"* section.
Are **audio signals** from internal speaker pads to **Retu D2200** ok?
NOK
Check **L2108, L2109, R2114, R2115, C2108, L2270, L2271, C2271, C2272, C2270**
Levels OK?
NOK
Replace **Retu D2200** and retest
OK
OK
OK
NOK
Does audio work **during a call?**
NOK
RAPGSM faulty. Beyond economical repair.
OK
Problem solved

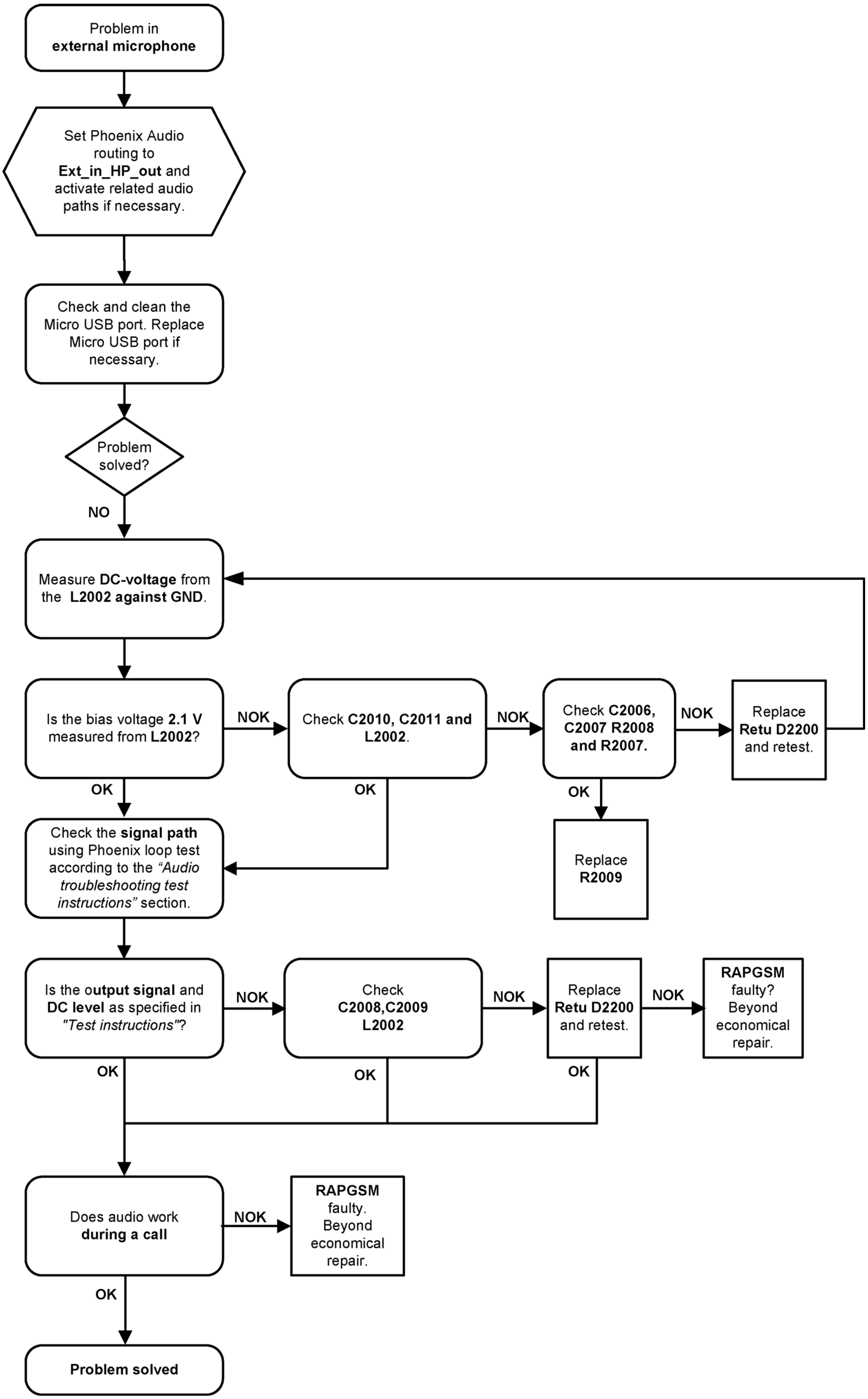
Internal microphone troubleshooting

Troubleshooting flow


Problem in the **internal microphone**
Set Phoenix audio routing to **HP_in_Ext_out** mode and activate related audio paths if necessary.
Check the microphone module and clean the PWB pads following the acoustics troubleshooting flowchart.
Problem solved?
NO
Voltage of C2110 > 1.7 V?
NO
Voltage on C2108 >1.7 V?
YES
Check L2106, C2109 and C2110 and replace.
NO
Voltage on C2106 >1.7 V?
Replace Retu (D2200)
YES
Voltage on Pin 3 of N2100 (use R2107) > 1.8V
YES
Replace N2100
NO
Replace Rapgsm (D2800)
YES
With oscilliscope, measure the voltage on R2109. Do you see 2.4 Mhz with 1.8 V amplitude?
NO
With oscilliscope, measure the voltage on L2105 Do you see 2.4 Mhz with 1.8 V amplitude?
YES
Replace R2108
NO
Is voltage on C2107 > 1.7 V
YES
Replace N2100
NO
Replace N2100. Retest. Working?
NO
Replace RapGSM (D2800)
YES
With oscilliscope, measure the voltage on C2107. Speak into the microphone, Do you see a square wave with 1.8 V amplitude?
NO
Replace B2201
YES
Resistance between L2105 to R2109 < 200 Ohm?
NO
Replace R2108
Yes
Replace Rapgsm (D2800)

External microphone troubleshooting

Troubleshooting flow


Problem in **external microphone**
Set Phoenix Audio routing to **Ext_in_HP_out** and activate related audio paths if necessary.
Check and clean the Micro USB port. Replace Micro USB port if necessary.
Problem solved?
NO
Measure **DC-voltage** from the **L2002 against GND**.
Is the bias voltage **2.1 V** measured from **L2002**?
NOK
Check **C2010, C2011 and L2002**.
NOK
Check **C2006, C2007 R2008 and R2007.**
NOK
Replace **Retu D2200** and retest.
OK
OK
OK
Replace **R2009**
Check the **signal path** using Phoenix loop test according to the *"Audio troubleshooting test instructions"* section.
Is the **output signal** and **DC level** as specified in *"Test instructions"*?
NOK
Check **C2008,C2009 L2002**
NOK
Replace **Retu D2200** and retest.
NOK
RAPGSM faulty? Beyond economical repair.
OK
OK
OK
Does audio work **during a call**
NOK
RAPGSM faulty. Beyond economical repair.
OK
Problem solved

Acoustics troubleshooting

Introduction to acoustics troubleshooting

Note: Always make sure all openings are clean and all contact pads are intact and make contact. If audio still does not work, please continue to the electronic audio troubleshooting (2nd diagram where applicable).

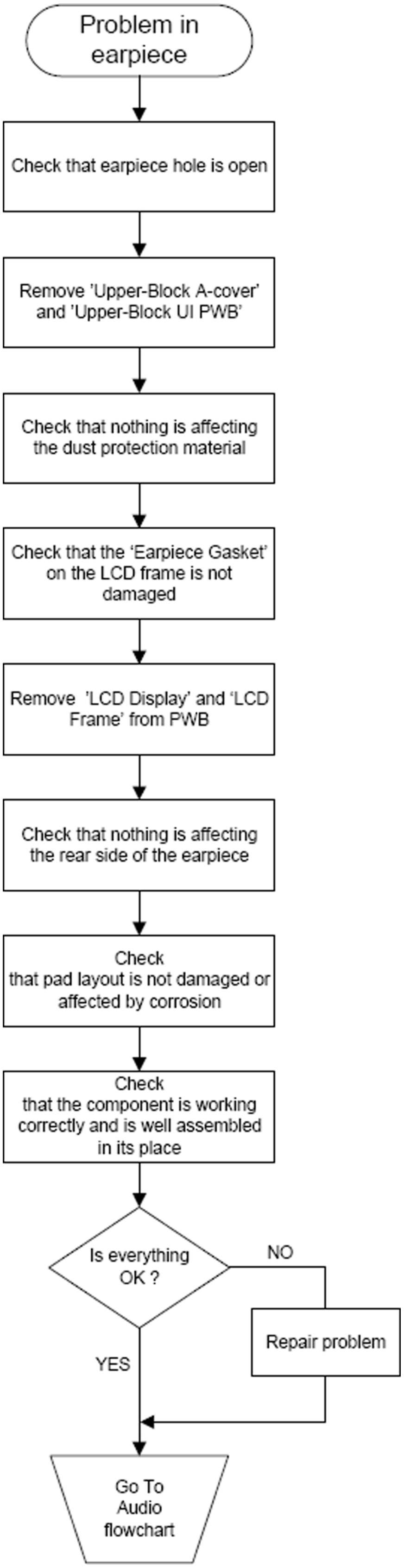
Acoustics design ensures that the sound is detected correctly with a microphone and properly radiated to the outside of the device by speaker(s). The acoustics of the phone includes three basic systems: earpiece, Integrated Hands Free (IHF) and microphone.

The sound reproduced from the earpiece readiates through a single hole on the front cover (A-cover). The sound reproduced from the IHF speaker radiates from a single sound hole located 3 cm below the power key. The microphone is located at the hinge, next to the system connector.

For a correct functionality of the phone, all sound holes must be always open. When the phone is used, care must be taken not to close any of those holes with a hand or fingers. The phone should be dry and clean, and no objects must be located in such a way that they close any of the holes.

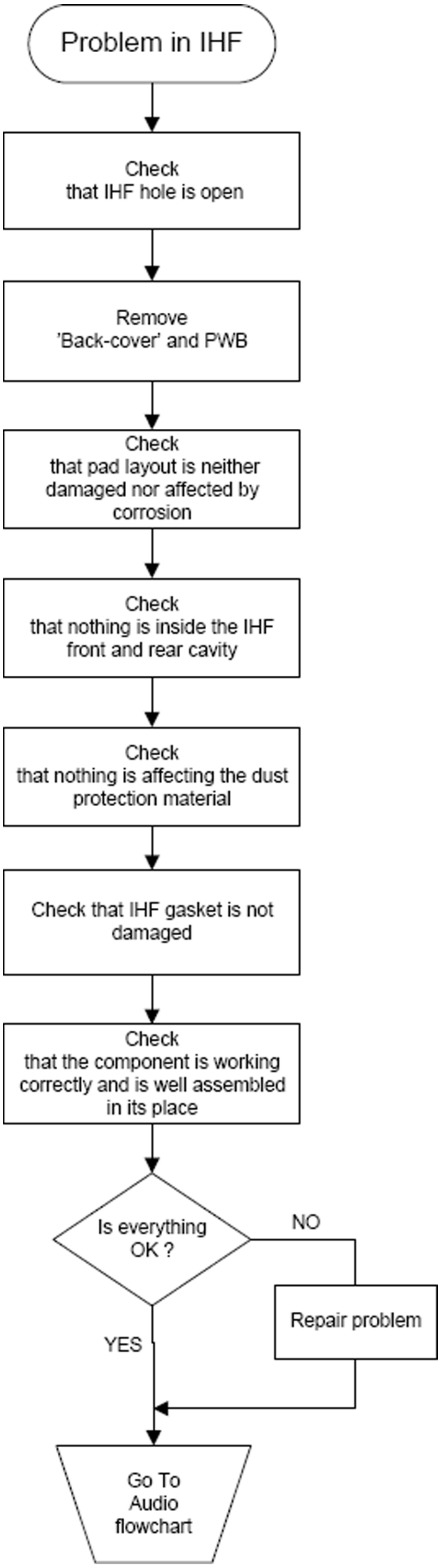
Earpiece troubleshooting

Troubleshooting flow


Problem in earpiece
Check that earpiece hole is open
Remove 'Upper-Block A-cover' and 'Upper-Block UI PWB'
Check that nothing is affecting the dust protection material
Check that the 'Earpiece Gasket' on the LCD frame is not damaged
Remove 'LCD Display' and 'LCD Frame' from PWB
Check that nothing is affecting the rear side of the earpiece
Check that pad layout is not damaged or affected by corrosion
Check that the component is working correctly and is well assembled in its place
Is everything OK ?
NO
Repair problem
YES
Go To Audio flowchart

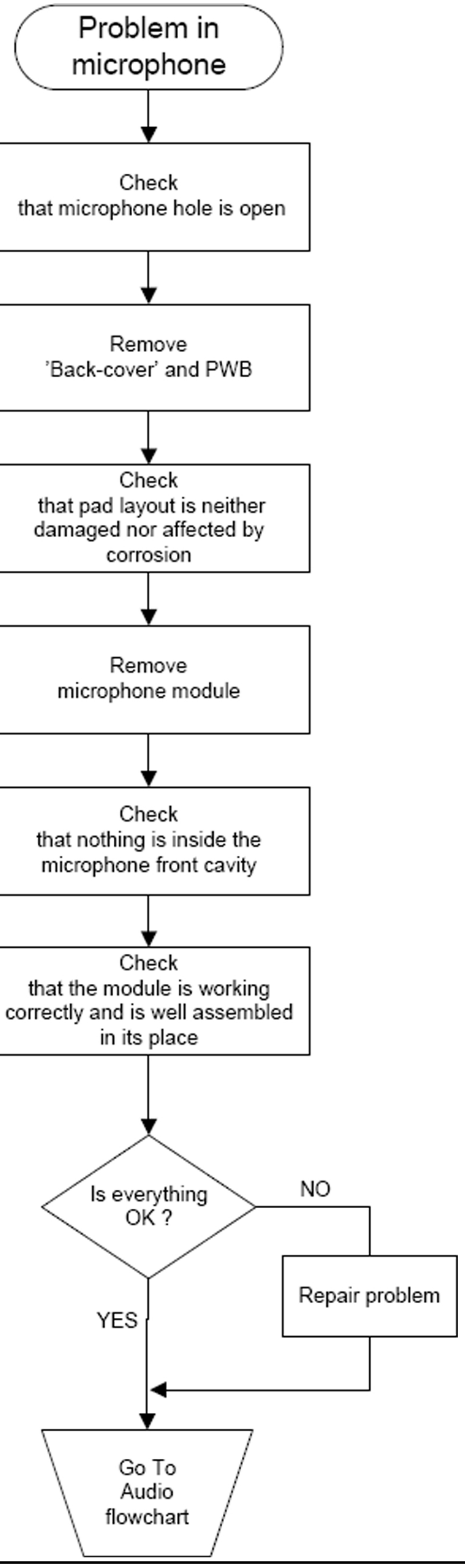
IHF troubleshooting

Troubleshooting flow


Problem in IHF
Check that IHF hole is open
Remove 'Back-cover' and PWB
Check that pad layout is neither damaged nor affected by corrosion
Check that nothing is inside the IHF front and rear cavity
Check that nothing is affecting the dust protection material
Check that IHF gasket is not damaged
Check that the component is working correctly and is well assembled in its place
Is everything OK ?
NO
Repair problem
YES
Go To Audio flowchart

Microphone troubleshooting

Troubleshooting flow


Problem in microphone
Check that microphone hole is open
Remove 'Back-cover' and PWB
Check that pad layout is neither damaged nor affected by corrosion
Remove microphone module
Check that nothing is inside the microphone front cavity
Check that the module is working correctly and is well assembled in its place
Is everything OK ?
NO
Repair problem
YES
Go To Audio flowchart

Connections troubleshooting

Bluetooth troubleshooting

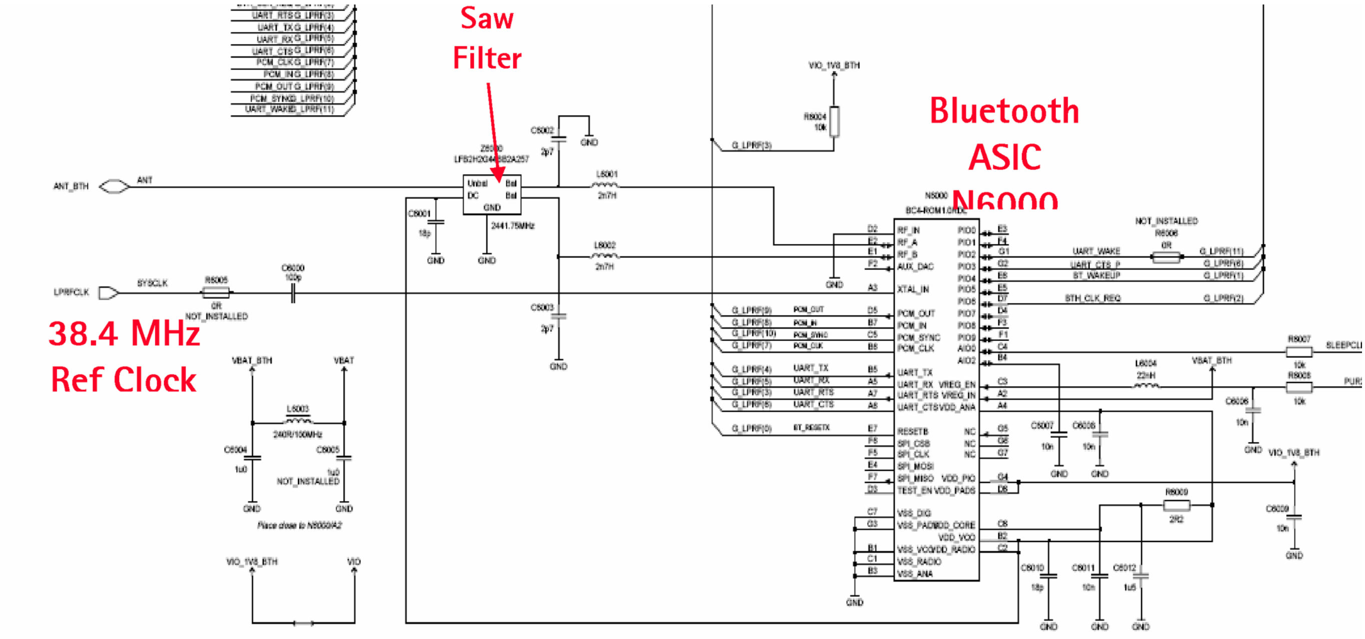
Introduction to Bluetooth troubleshooting

There are two main Bluetooth (BT) problems that can occur:

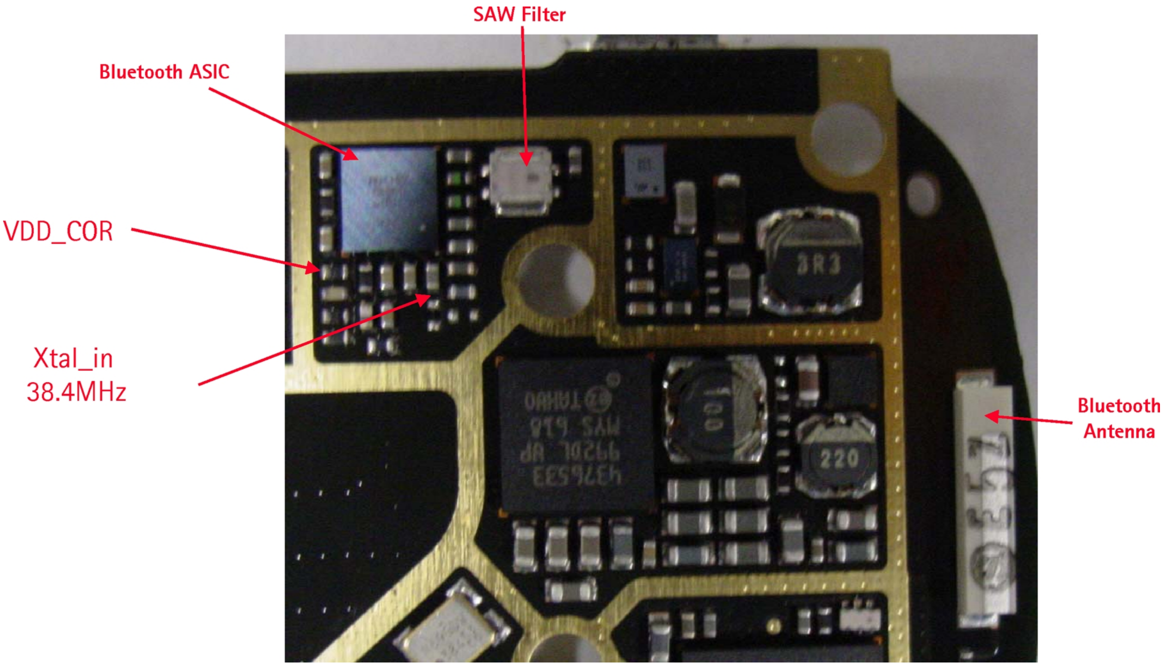
Problem	Description
Detachment of the BT antenna.	This would most likely happen if the device has been dropped repeatedly to the ground. It could cause the BT antenna to become loose or partially detached from the PWB.
A malfunction in the BT ASIC, BB ASICs or the phone's BT SMD components.	This is unpredictable and could have many causes i.e. SW or HW related.

The main issue is to find out if the problem is related to the BT antenna or related to the BT system or the phone's BB and then replace/fix the faulty component. For location of the antenna, please refer to the exploded view in the Parts and layouts section.

Bluetooth schematic


Saw Filter
Bluetooth ASIC N6000
38.4 MHz Ref Clock
ANT_BTH
ANT
LPRFCLK
SYSCLK
R6005
C6000
Z6000
C6001
C6002
C6003
L6001
L6002
L6003
C6004
C6005
VBAT_BTH
VBAT
VIO_1V8_BTH
VIO
R6004
N6000
BC4-ROM10
GND
NOT_INSTALLED

Bluetooth DC and RF test points



Bluetooth settings for Phoenix

Steps

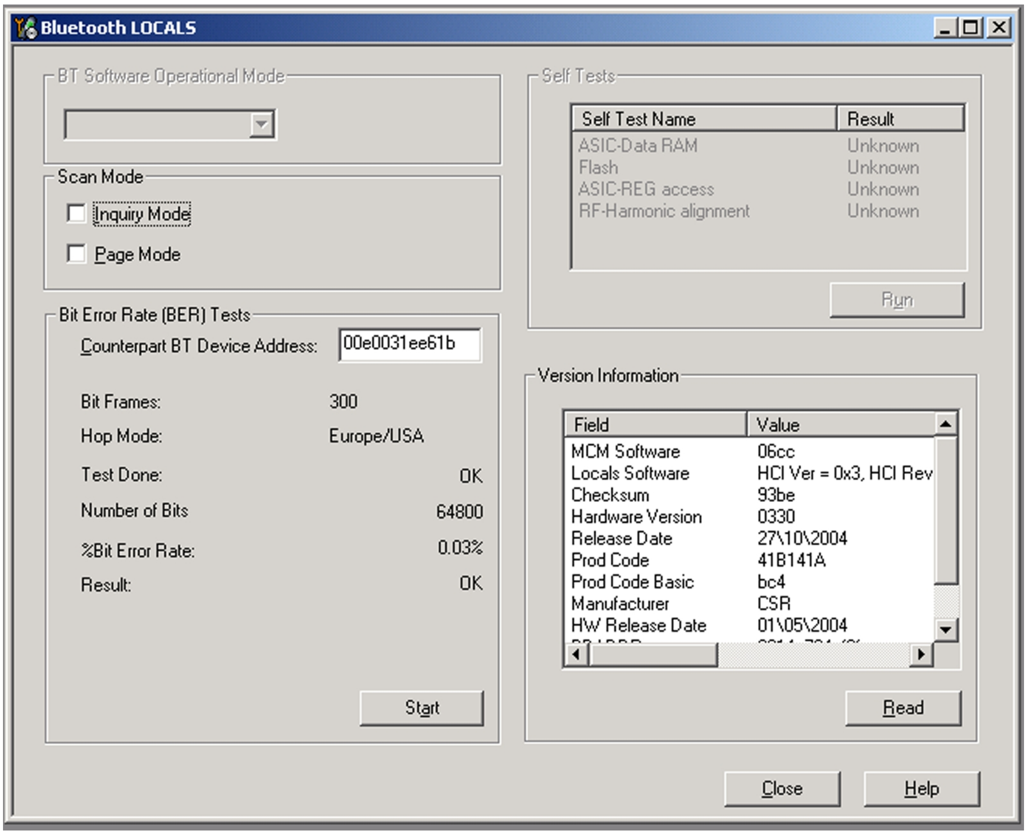
1. Start *Phoenix* service software.
2. From the **File** menu, choose **Open Product**, and then choose the correct type designator from the **Product** list.
3. Place the phone to a flash adapter in the local mode.
4. Choose **Testing→Bluetooth LOCALS** .
5. Locate JBT-9's serial number (12 digits) found in the type label on the back of JBT-9.

   In addition to JBT-9, also SB-6, JBT-3 and JBT-6 Bluetooth test boxes can be used.
6. In the *Bluetooth LOCALS* window, write the 12-digit serial number on the **Counterpart BT Device Address** line.

   This needs to be done only once provided that JBT-9 is not changed.
7. Place the JBT-9 box near (within 10 cm) the BT antenna and click **Run BER Test**.

Results

Bit Error Rate test result is displayed in the *Bit Error Rate (BER) Tests* pane in the *Bluetooth LOCALS* window.


Bluetooth LOCALS
BT Software Operational Mode
Scan Mode
☐ Inquiry Mode
☐ Page Mode
Bit Error Rate (BER) Tests
Start
Self Tests
Run
Version Information
Read
Close
Help

Counterpart BT Device Address: 00e0031ee61b

Bit Frames: 300
Hop Mode: Europe/USA
Test Done: OK
Number of Bits: 64800
%Bit Error Rate: 0.03%
Result: OK

Self Test Name	Result
ASIC-Data RAM	Unknown
Flash	Unknown
ASIC-REG access	Unknown
RF-Harmonic alignment	Unknown

Field	Value
MCM Software	06cc
Locals Software	HCI Ver = 0x3, HCI Rev
Checksum	93be
Hardware Version	0330
Release Date	27\10\2004
Prod Code	41B141A
Prod Code Basic	bc4
Manufacturer	CSR
HW Release Date	01\05\2004

Figure 14 BER test result

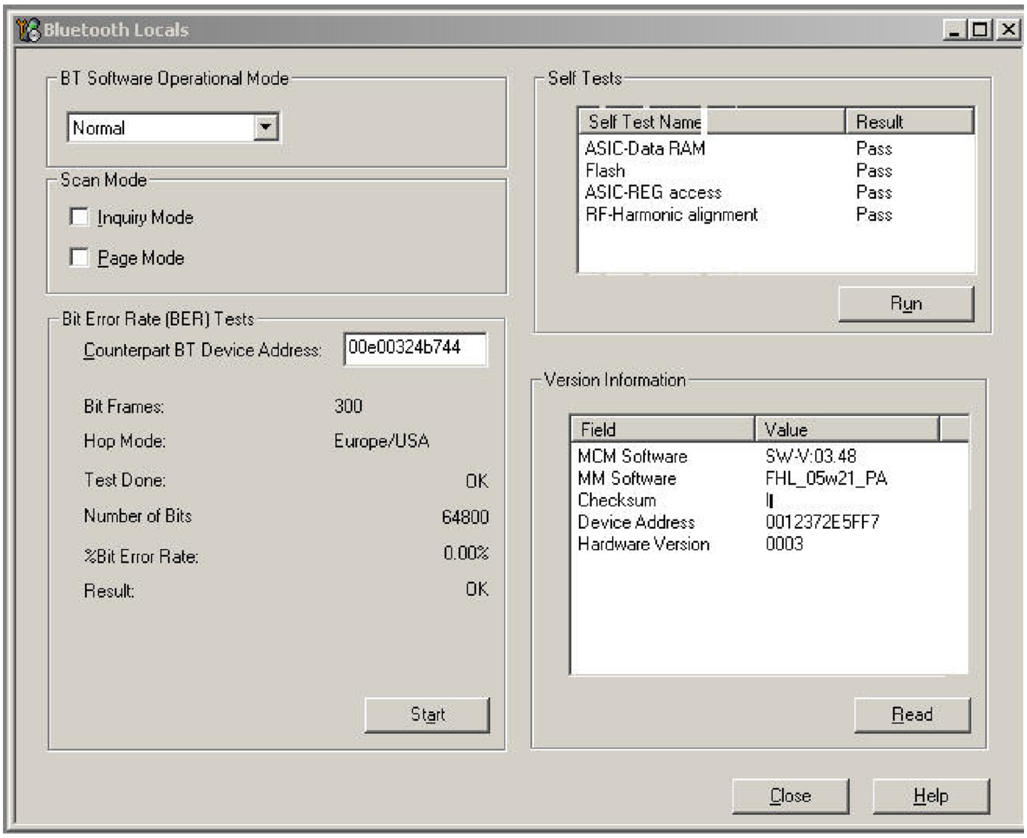
Bluetooth Phoenix and test setup

Steps

1. Go to the **Testing** menu, select **Bluetooth Locals**.

   Note: If BER tests had been running previously, you must re-start **BT Locals** before performing the **Self Tests**.

   If the *Phoenix* connection to the phone's BT ASIC is OK, you will see text displayed in the *Version Information* window, such as MCM Software, MM Software.



BT Software Operational Mode: Normal

Scan Mode
☐ Inquiry Mode
☐ Page Mode

Bit Error Rate (BER) Tests
Counterpart BT Device Address: 00e00324b744
Bit Frames: 300
Hop Mode: Europe/USA
Test Done: OK
Number of Bits: 64800
%Bit Error Rate: 0.00%
Result: OK

Self Tests

Self Test Name	Result
ASIC-Data RAM	Pass
Flash	Pass
ASIC-REG access	Pass
RF-Harmonic alignment	Pass

Version Information

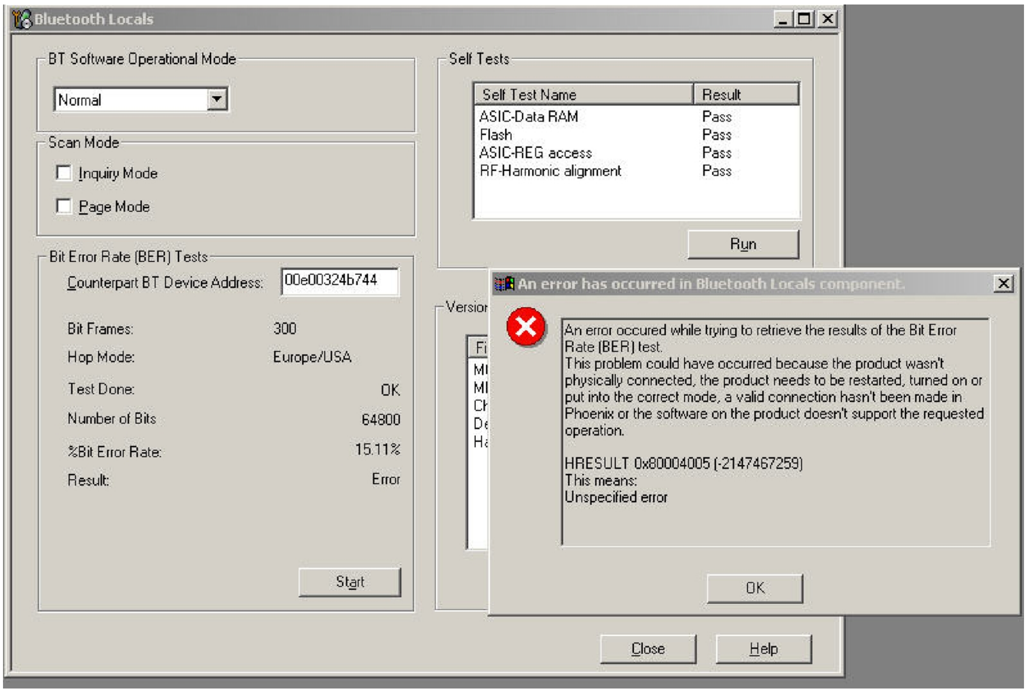
Field	Value
MCM Software	SW-V:03.48
MM Software	FHL_05w21_PA
Checksum	ll
Device Address	0012372E5FF7
Hardware Version	0003

If “No version information available” is present in the *Version Information* window, it might either be a *Phoenix* connection problem BT ASIC or the BT ASIC is not working. See case 1 in Bluetooth troubleshooting (page 3–45).

2. After getting the version information, click **Run** to do a quick check on the BT ASIC. The results of each self-test will display in the *Self Tests* window. If any test fails, BT ASIC is not working properly. Change BT ASIC.
3. After passing the self-test, setup the SB-6 BT box, key in the BT box’s device address into **Counterpart BT Device Address**.
4. Click **Run BER Test** to run the BER loopback test.

   See the BER result in the *BER Test Results* window. Since this is a “go no-go” testing, make sure the test-jig / coupler is set up right. It is recommended to run a couple of “good” phones in order to get better correlation. The acceptance criteria is BER<0.1%.
5. If the phone’s BT sensitivity is not good or if the setup is not calibrated (correlated) right, you will see the %BER > 0.1% which results in Error. Go back to make sure the setup is correct (correlated with a golden phone), then see case 2 in Bluetooth troubleshooting (page 3–45).

   If the phone is placed too far away or the BT TX or RX has problem, you might see the following error message. See case 2 of Bluetooth troubleshooting (page 3–45).



BT Software Operational Mode: Normal

Scan Mode

☐ Inquiry Mode

☐ Page Mode

Bit Error Rate (BER) Tests

Counterpart BT Device Address:	00e00324b744
Bit Frames:	300
Hop Mode:	Europe/USA
Test Done:	OK
Number of Bits	64800
%Bit Error Rate:	15.11%
Result:	Error

Self Tests

Self Test Name	Result
ASIC-Data RAM	Pass
Flash	Pass
ASIC-REG access	Pass
RF-Harmonic alignment	Pass

An error has occurred in Bluetooth Locals component.

An error occured while trying to retrieve the results of the Bit Error Rate (BER) test.
This problem could have occurred because the product wasn't physically connected, the product needs to be restarted, turned on or put into the correct mode, a valid connection hasn't been made in Phoenix or the software on the product doesn't support the requested operation.

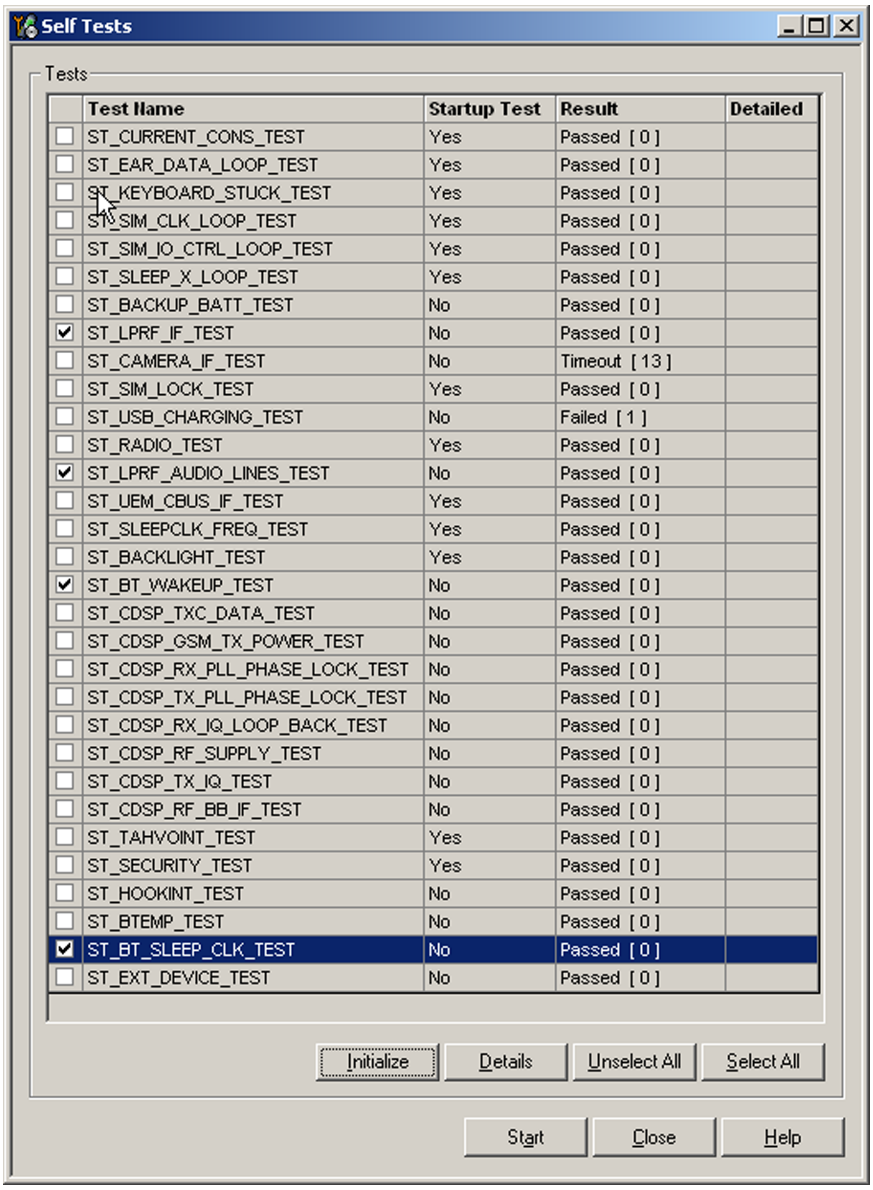
HRESULT 0x80004005 (-2147467259)
This means:
Unspecified error

Bluetooth self tests in Phoenix

Steps

1. Start *Phoenix* service software.
2. Choose**File→Scan Product.**
3. Place the phone to a flash adapter.
4. From the **Mode** drop-down menu, set mode to **Local**.
5. Choose **Testing→Self Tests.**
6. In the *Self Tests* window check the following Bluetooth related tests:
   - **ST_LPRF_IF_TEST**
   - **ST_LPRF_AUDIO_LINES_TEST**
   - **ST_BT_WAKEUP_TEST**
   - **ST_BT_SLEEP_CLK_TEST**

7. To run the tests, click **Start**.

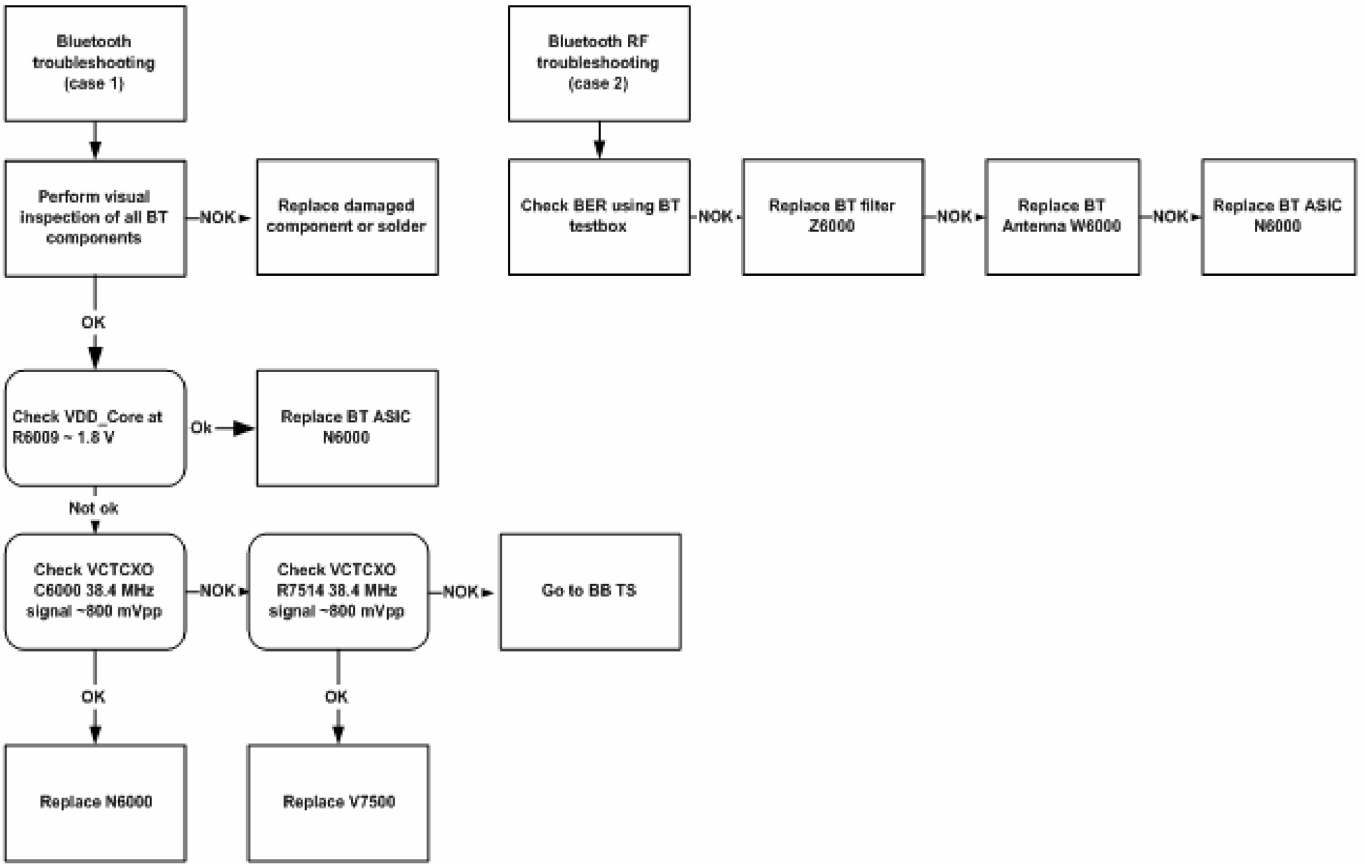


	Test Name	Startup Test	Result	Detailed
☐	ST_CURRENT_CONS_TEST	Yes	Passed [0]	
☐	ST_EAR_DATA_LOOP_TEST	Yes	Passed [0]	
☐	ST_KEYBOARD_STUCK_TEST	Yes	Passed [0]	
☐	ST_SIM_CLK_LOOP_TEST	Yes	Passed [0]	
☐	ST_SIM_IO_CTRL_LOOP_TEST	Yes	Passed [0]	
☐	ST_SLEEP_X_LOOP_TEST	Yes	Passed [0]	
☐	ST_BACKUP_BATT_TEST	No	Passed [0]	
☑	ST_LPRF_IF_TEST	No	Passed [0]	
☐	ST_CAMERA_IF_TEST	No	Timeout [13]	
☐	ST_SIM_LOCK_TEST	Yes	Passed [0]	
☐	ST_USB_CHARGING_TEST	No	Failed [1]	
☐	ST_RADIO_TEST	Yes	Passed [0]	
☑	ST_LPRF_AUDIO_LINES_TEST	No	Passed [0]	
☐	ST_UEM_CBUS_IF_TEST	Yes	Passed [0]	
☐	ST_SLEEPCLK_FREQ_TEST	Yes	Passed [0]	
☐	ST_BACKLIGHT_TEST	Yes	Passed [0]	
☑	ST_BT_WAKEUP_TEST	No	Passed [0]	
☐	ST_CDSP_TXC_DATA_TEST	No	Passed [0]	
☐	ST_CDSP_GSM_TX_POWER_TEST	No	Passed [0]	
☐	ST_CDSP_RX_PLL_PHASE_LOCK_TEST	No	Passed [0]	
☐	ST_CDSP_TX_PLL_PHASE_LOCK_TEST	No	Passed [0]	
☐	ST_CDSP_RX_IQ_LOOP_BACK_TEST	No	Passed [0]	
☐	ST_CDSP_RF_SUPPLY_TEST	No	Passed [0]	
☐	ST_CDSP_TX_IQ_TEST	No	Passed [0]	
☐	ST_CDSP_RF_BB_IF_TEST	No	Passed [0]	
☐	ST_TAHVOINT_TEST	Yes	Passed [0]	
☐	ST_SECURITY_TEST	Yes	Passed [0]	
☐	ST_HOOKINT_TEST	No	Passed [0]	
☐	ST_BTEMP_TEST	No	Passed [0]	
☑	ST_BT_SLEEP_CLK_TEST	No	Passed [0]	
☐	ST_EXT_DEVICE_TEST	No	Passed [0]	

Figure 15 Bluetooth self tests in *Phoenix*

Bluetooth troubleshooting

Troubleshooting flow

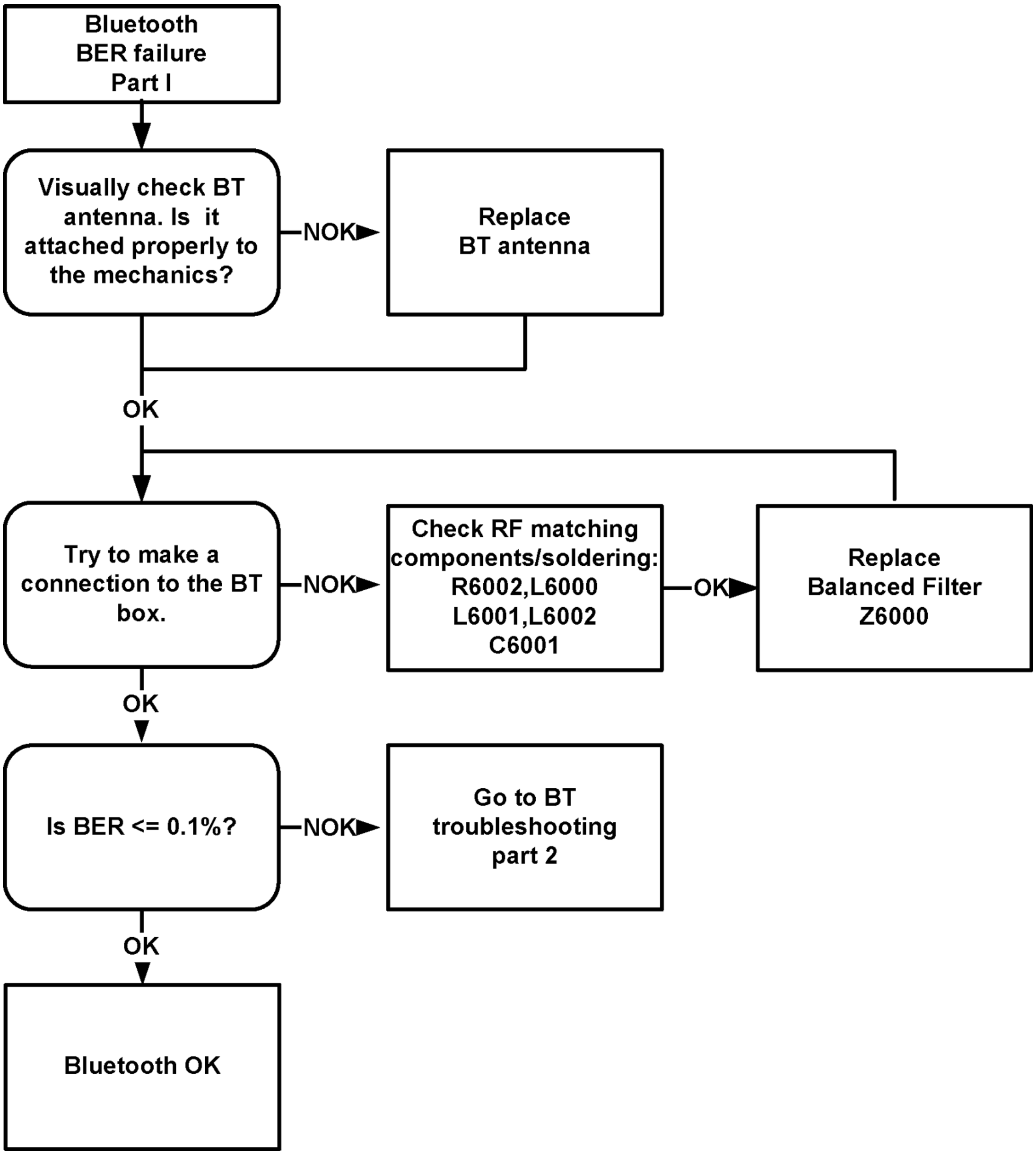

Bluetooth troubleshooting (case 1)
Perform visual inspection of all BT components
NOK
Replace damaged component or solder
OK
Check VDD_Core at R6009 ~ 1.8 V
Ok
Replace BT ASIC N6000
Not ok
Check VCTCXO C6000 38.4 MHz signal ~800 mVpp
NOK
Check VCTCXO R7514 38.4 MHz signal ~800 mVpp
NOK
Go to BB TS
OK
Replace N6000
OK
Replace V7500
Bluetooth RF troubleshooting (case 2)
Check BER using BT testbox
NOK
Replace BT filter Z6000
NOK
Replace BT Antenna W6000
NOK
Replace BT ASIC N6000

Bluetooth BER failure troubleshooting

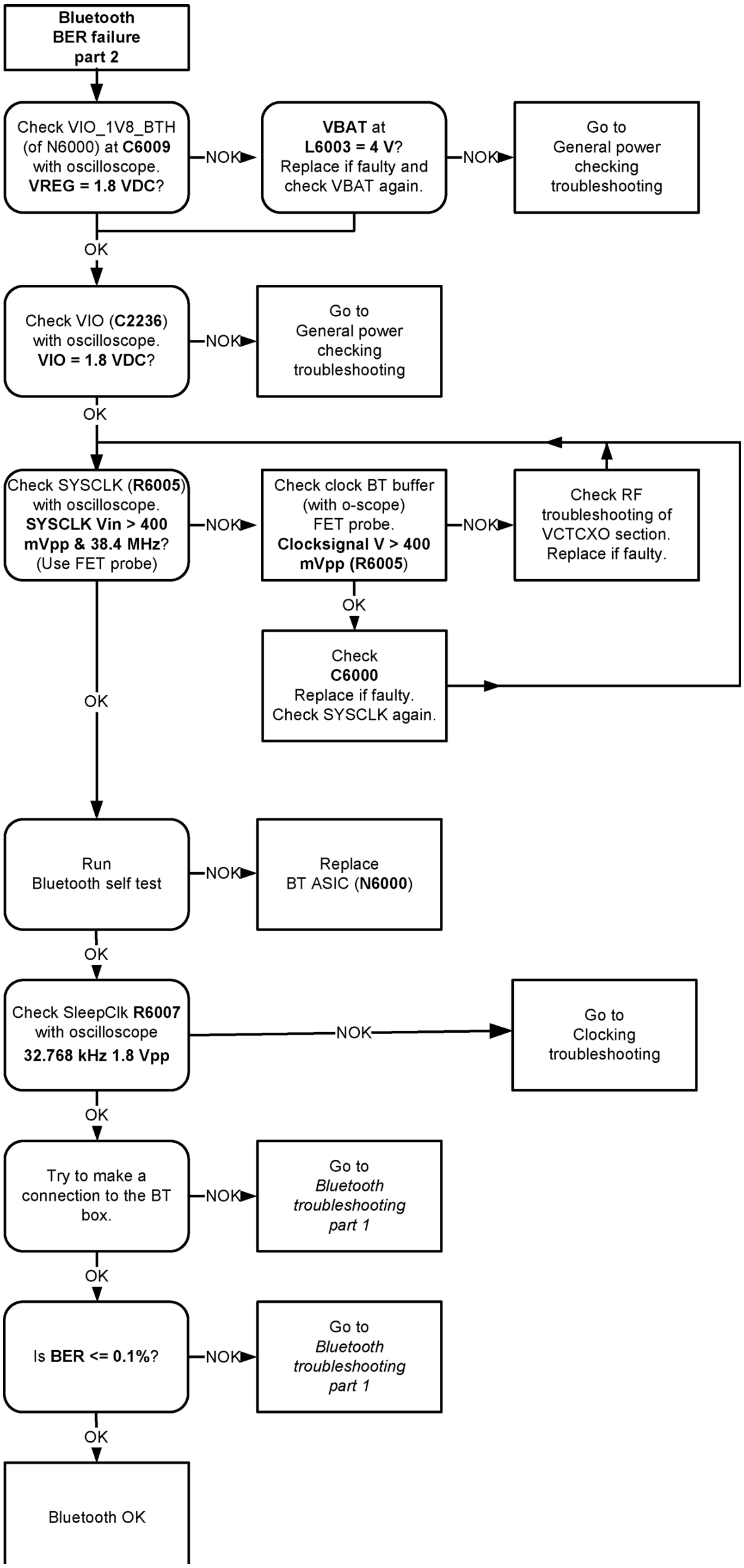
Context

Basic encoding rules, BER, is a self-identifying and self-delimiting encoding scheme, which means that each data value can be identified, extracted and decoded individually.

Part 1: Bluetooth self test passed but BER test failed

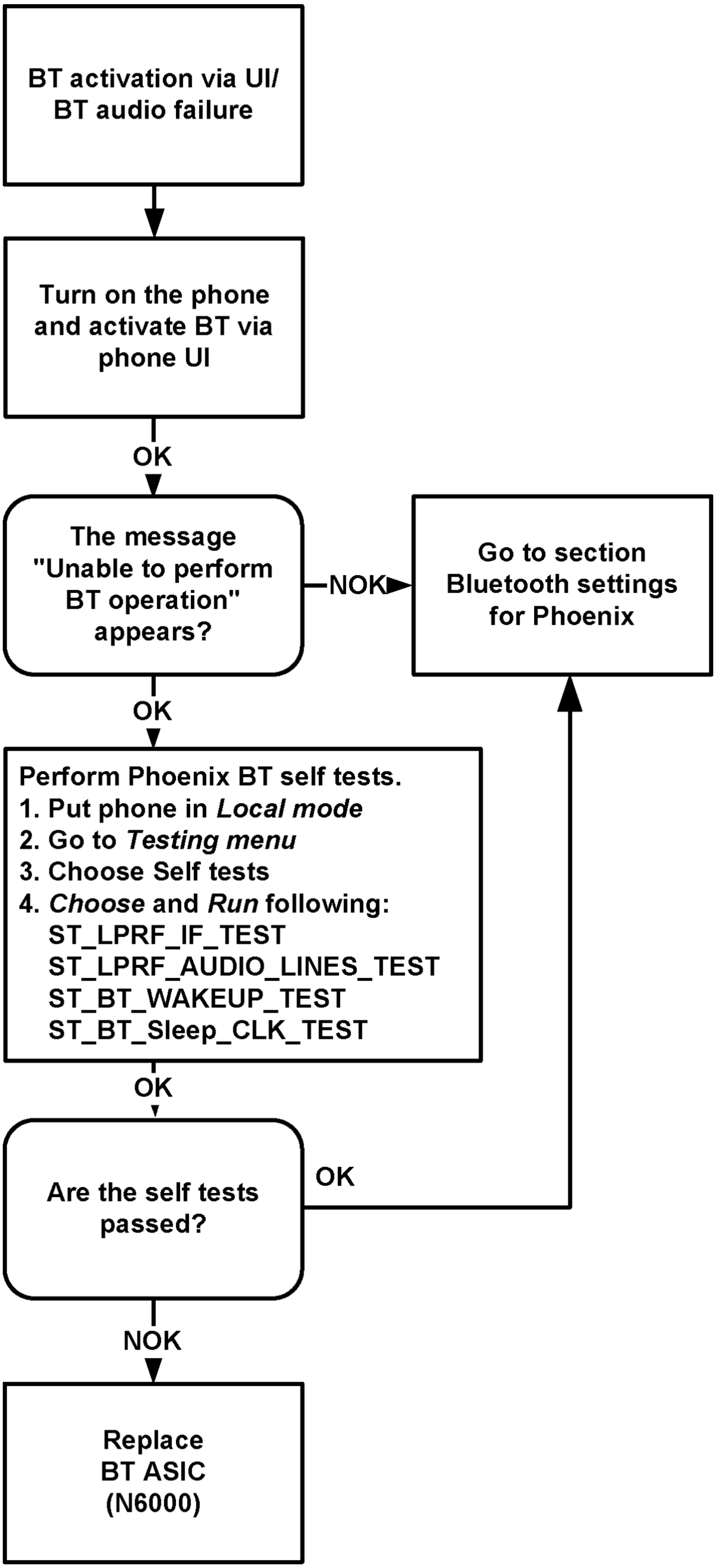

Bluetooth BER failure Part I
Visually check BT antenna. Is it attached properly to the mechanics?
NOK
Replace BT antenna
OK
Try to make a connection to the BT box.
NOK
Check RF matching components/soldering: R6002,L6000 L6001,L6002 C6001
OK
Replace Balanced Filter Z6000
OK
Is BER <= 0.1%?
NOK
Go to BT troubleshooting part 2
OK
Bluetooth OK

Part 2: Bluetooth self test failed


Bluetooth BER failure part 2
Check VIO_1V8_BTH (of N6000) at C6009 with oscilloscope. VREG = 1.8 VDC?
NOK
VBAT at L6003 = 4 V? Replace if faulty and check VBAT again.
NOK
Go to General power checking troubleshooting
OK
Check VIO (C2236) with oscilloscope. VIO = 1.8 VDC?
NOK
Go to General power checking troubleshooting
OK
Check SYSCLK (R6005) with oscilloscope. SYSCLK Vin > 400 mVpp & 38.4 MHz? (Use FET probe)
NOK
Check clock BT buffer (with o-scope) FET probe. Clocksignal V > 400 mVpp (R6005)
NOK
Check RF troubleshooting of VCTCXO section. Replace if faulty.
OK
Check C6000 Replace if faulty. Check SYSCLK again.
OK
Run Bluetooth self test
NOK
Replace BT ASIC (N6000)
OK
Check SleepClk R6007 with oscilloscope 32.768 kHz 1.8 Vpp
NOK
Go to Clocking troubleshooting
OK
Try to make a connection to the BT box.
NOK
Go to Bluetooth troubleshooting part 1
OK
Is BER <= 0.1%?
NOK
Go to Bluetooth troubleshooting part 1
OK
Bluetooth OK

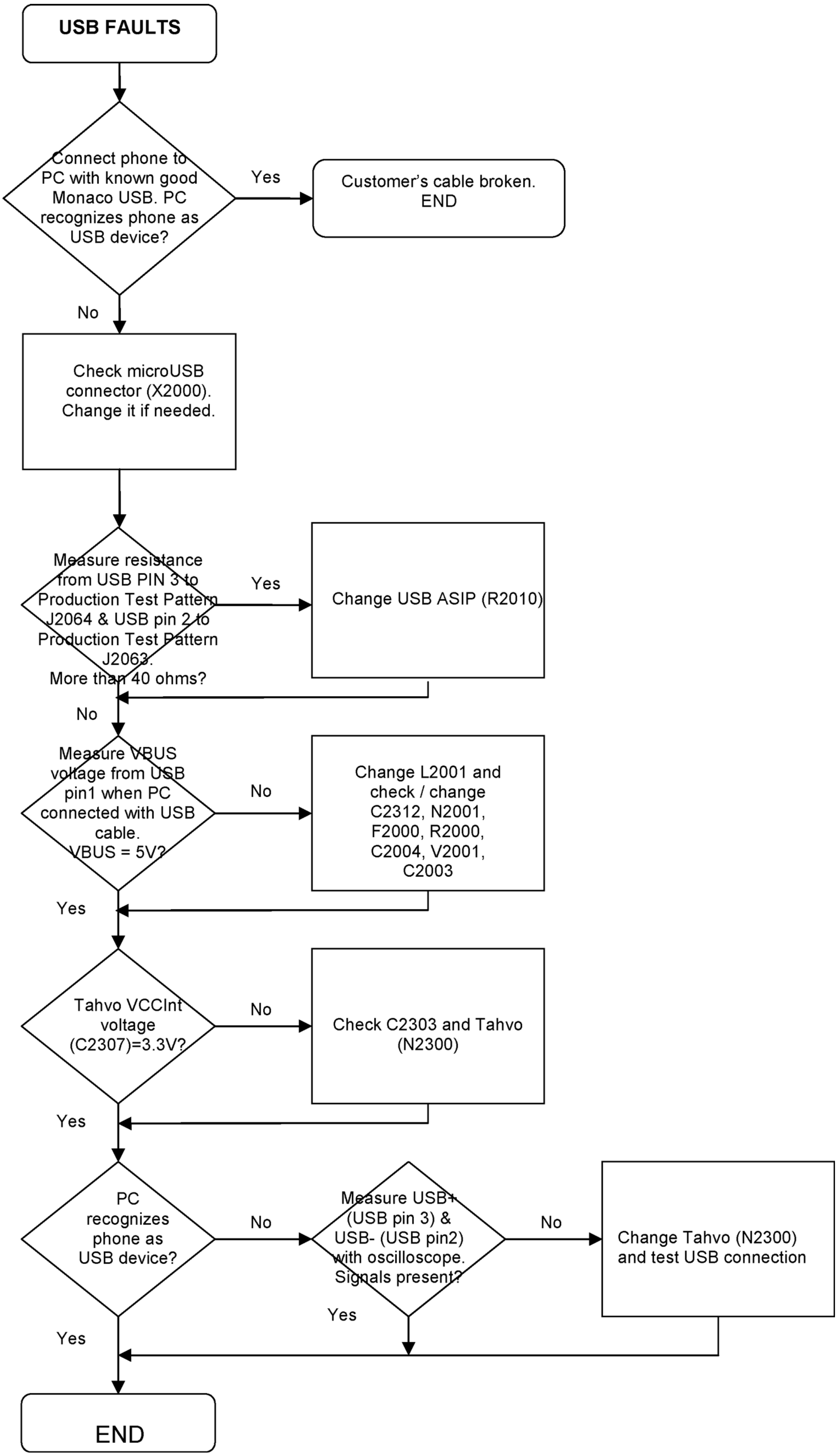
Bluetooth audio and UI activation troubleshooting

Troubleshooting flow


BT activation via UI/ BT audio failure
Turn on the phone and activate BT via phone UI
OK
The message "Unable to perform BT operation" appears?
NOK
Go to section Bluetooth settings for Phoenix
OK
Perform Phoenix BT self tests.
1. Put phone in Local mode
2. Go to Testing menu
3. Choose Self tests
4. Choose and Run following:
ST_LPRF_IF_TEST
ST_LPRF_AUDIO_LINES_TEST
ST_BT_WAKEUP_TEST
ST_BT_Sleep_CLK_TEST
OK
Are the self tests passed?
OK
NOK
Replace BT ASIC (N6000)

USB troubleshooting

Troubleshooting flow


USB FAULTS
Connect phone to PC with known good Monaco USB. PC recognizes phone as USB device?
Yes
Customer's cable broken. END
No
Check microUSB connector (X2000). Change it if needed.
Measure resistance from USB PIN 3 to Production Test Pattern J2064 & USB pin 2 to Production Test Pattern J2063. More than 40 ohms?
Yes
Change USB ASIP (R2010)
No
Measure VBUS voltage from USB pin1 when PC connected with USB cable. VBUS = 5V?
No
Change L2001 and check / change C2312, N2001, F2000, R2000, C2004, V2001, C2003
Yes
Tahvo VCCInt voltage (C2307)=3.3V?
No
Check C2303 and Tahvo (N2300)
Yes
PC recognizes phone as USB device?
No
Measure USB+ (USB pin 3) & USB- (USB pin2) with oscilloscope. Signals present?
No
Change Tahvo (N2300) and test USB connection
Yes
Yes
END

Baseband manual tuning guide

Certificate restoring for BB5 products

Context

This procedure is performed when the device certificate is corrupted for some reason.

All tunings (RF & Baseband, UI) must be done after performing the certificate restoring procedure.

The procedure for certificate restoring is the following:

- Flash the phone with the latest available software using FPS-10.
- Create a request file.
- Send the file to Nokia by e-mail. Use the following addresses depending on your location:
  - APAC: sydney.service@nokia.com
  - CHINA: repair.ams@nokia.com
  - E&A: salo.repair@nokia.com
  - AMERICAS: fls1.usa@nokia.com
- When you receive a reply from Nokia, carry out certificate restoring.
- Tune the phone completely.

  Note: SX-4 smart card is needed.
- If the phone resets after certificate restoring, reflash the phone again.

Required equipment and setup:

- *Phoenix* service software v 2004.39.7.70 or newer.
- The latest phone model specific *Phoenix* data package.
- PKD-1 dongle
- SX-4 smart card (Enables BB5 testing and tuning features)
- FPS-10 flash prommer
- Flash update package 03.18.004 or newer for FPS-10 flash prommer
- CU-4 control unit
- USB cable from PC USB Port to CU-4 control unit
- Phone model specific adapter for CU-4 control unit
- PCS-1 cable to power CU-4 from external power supply
- XCS-4 modular cable between flash prommer and CU-4

  Note: CU-4 must be supplied with +12 V from an external power supply in all steps of certificate restoring.

Steps

1. Program the phone software.

   i Start *Phoenix* and login. Make sure the connection has been managed correctly for FPS-10.

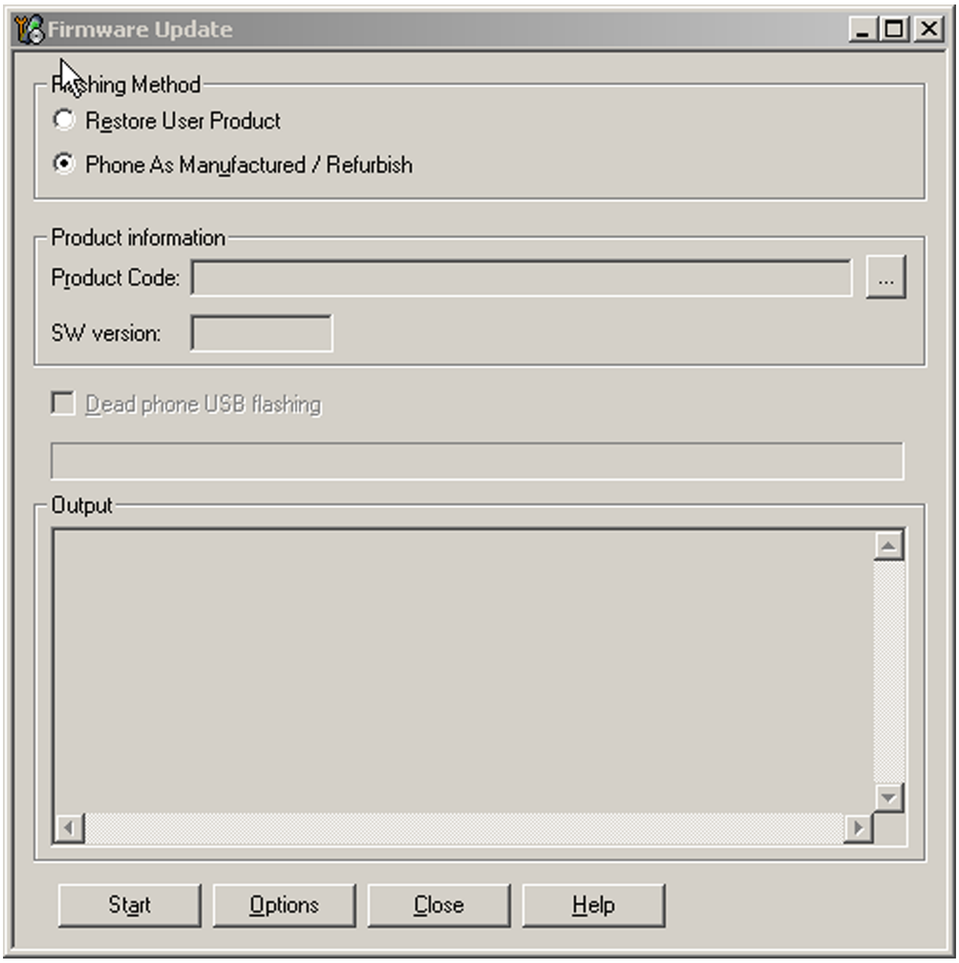
   ii Update the phone MCU software to the latest available version.

   If the new flash is empty and the phone cannot communicate with *Phoenix*, reflash the phone.

   iii Choose the product manually from **File→Open Product**, and click **OK**.

   Wait for the phone type designator (e.g. “RM-1”) to be displayed in the status bar.

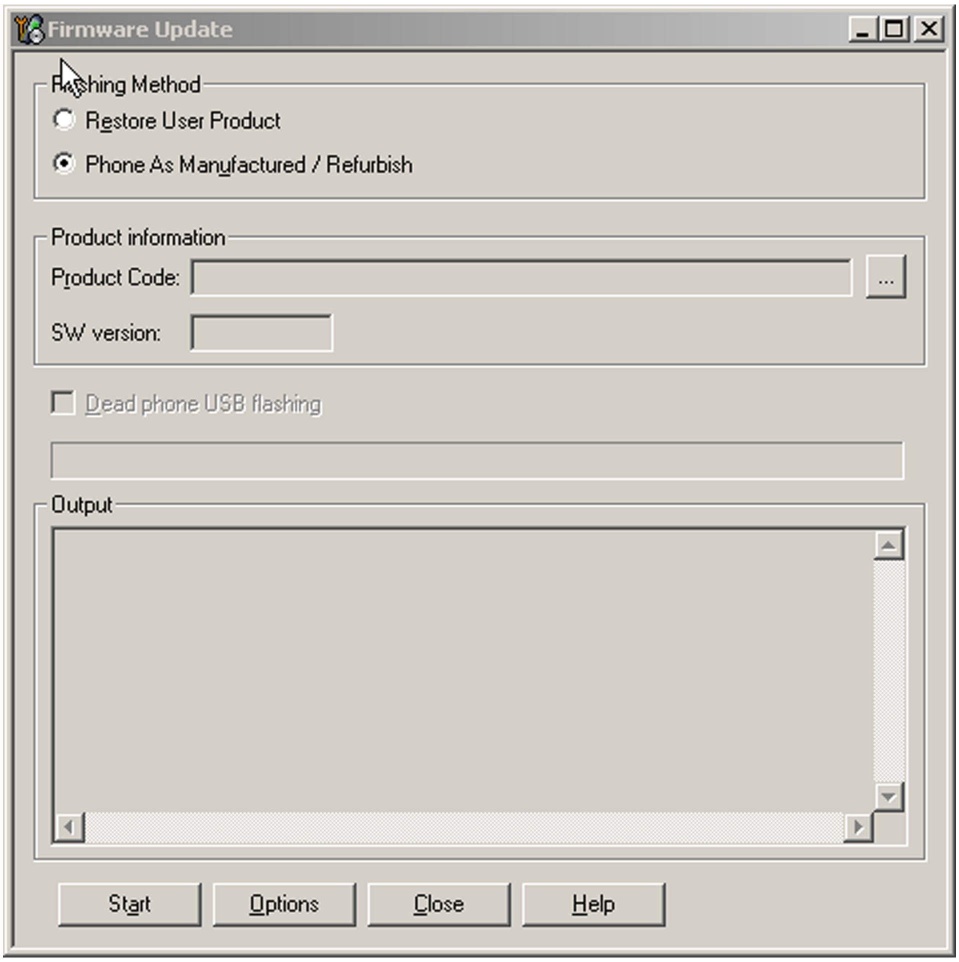
iv Go to **Flashing→Firmware Update** and wait until *Phoenix* reads the product data as shown in the following picture.


Firmware Update
Product information
Product Code:
...
SW version:
☐ Dead phone USB flashing
Output
Start
Options
Close
Help

Flashing Method
○ Restore User Product
● Phone As Manufactured / Refurbish

v To continue, click **Start**.

Progress bars and messages on the screen show actions during phone programming, please wait.


Firmware Update
Flashing Method
○ Restore User Product
● Phone As Manufactured / Refurbish
Product information
Product Code:
...
SW version:
☐ Dead phone USB flashing
Output
Start
Options
Close
Help

Programming is completed when *Flashing Completed* message is displayed.

The product type designator and MCU SW version are displayed in the status bar.

vi Close the *Firmware Update* window and then choose **File→Close Product** .

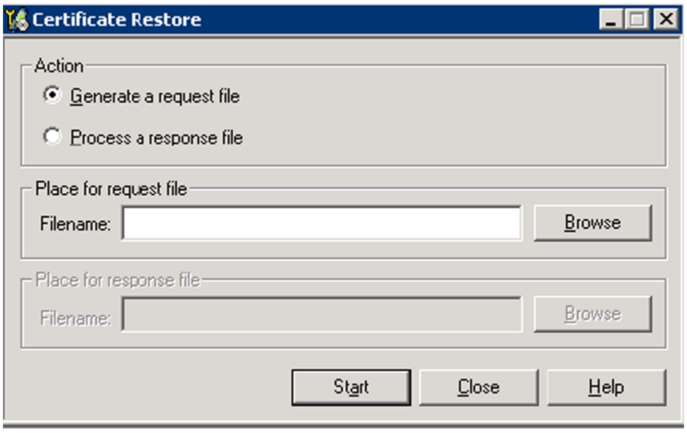
2. Create a *Request* file.

For this procedure, you must supply +12 V to CU-4 from an external power supply.

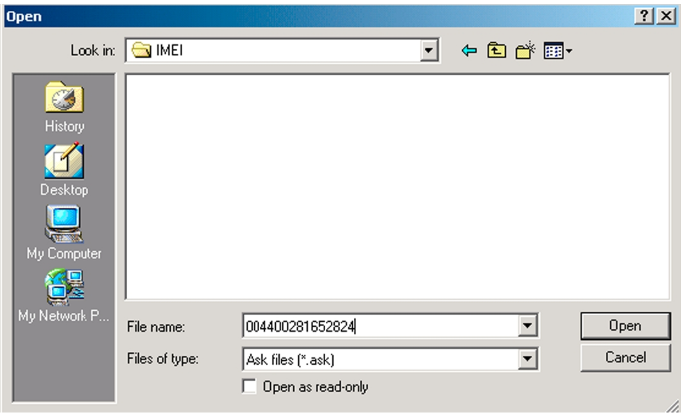
i To connect the phone with *Phoenix*, choose **File→Scan Product** .

ii Choose **Tools→Certificate Restore** .

iii To choose a location for the request file, click **Browse**.


Certificate Restore
Action
● Generate a request file
○ Process a response file
Place for request file
Filename:
Browse
Place for response file
Filename:
Browse
Start
Close
Help

iv Name the file so that you can easily identify it, and click **Open**.


Open
History
Desktop
My Computer
My Network P...
Open
Cancel

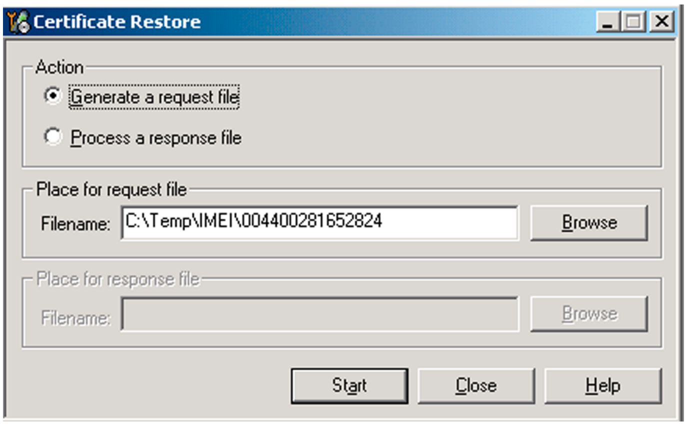
Look in: IMEI

File name: 004400281652824

Files of type: Ask files (*.ask)

☐ Open as read-only

The name of the file and its location are shown.


Certificate Restore
Browse
Browse
Start
Close
Help

Action

● Generate a request file

○ Process a response file

Place for request file

Filename: C:\Temp\IMEI\004400281652824

Place for response file

Filename:

v To create the *Request* file, click **Start**.

vi When the file for certificate restore has been created, send it to Nokia as an e-mail attachment.

3. Restore certificate.

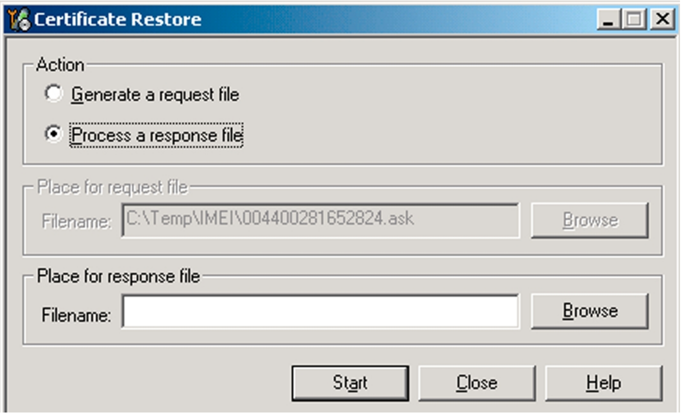
For this procedure, you must supply +12 V to CU-4 from an external power supply.

i Save the reply file sent by Nokia to your computer.

ii Start *Phoenix* service software.

iii Choose **File→Scan Product** .

iv From the **Tools** menu, choose **Certificate Restore** and select **Process a response file** in the *Action* pane.



Certificate Restore
Action
Browse
Place for response file
Browse
Start
Close
Help

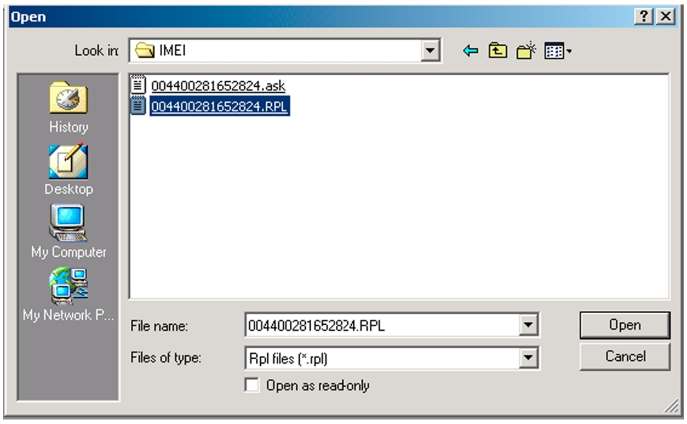
○ Generate a request file
● Process a response file

Place for request file
Filename: C:\Temp\IMEI\004400281652824.ask

Filename:

v To choose the location where response file is saved, click **Browse**.

vi Click **Open**.



Open
History
Desktop
My Computer
My Network P...
Open
Cancel

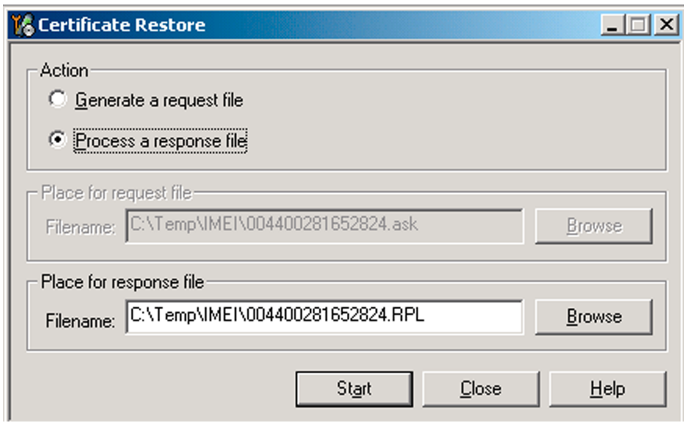
Look in: IMEI

004400281652824.ask
004400281652824.RPL

File name: 004400281652824.RPL
Files of type: Rpl files (*.rpl)
☐ Open as read-only

The name of the file and the path where it is located are shown.

vii To write the file to phone, click **Start**.



Certificate Restore
Action
Browse
Place for response file
Browse
Start
Close
Help

○ Generate a request file
● Process a response file

Place for request file
Filename: C:\Temp\IMEI\004400281652824.ask

Filename: C:\Temp\IMEI\004400281652824.RPL

Next actions

After a successful rewrite, you must retune the phone completely by using *Phoenix* tuning functions.

Important: Perform all tunings: RF, BB, and UI.

Energy management calibration

Prerequisites

Energy Management (EM) calibration is performed to calibrate the setting (gain and offset) of AD converters in several channels (that is, **battery voltage**, **BSI**, **battery current**) to get an accurate AD conversion result.

Hardware setup:

- An external power supply is needed.
- Supply 12V DC from an external power supply to CU-4 to power up the phone.
- The phone must be connected to a CU-4 control unit with a product-specific flash adapter.

Steps

1. Place the phone to the docking station adapter (CU-4 is connected to the adapter).
2. Start *Phoenix* service software.
3. Choose **File**→ **Scan Product.**
4. Choose **Tuning**→**Energy Management Calibration.**
5. To show the current values in the phone memory, click **Read**, and check that communication between the phone and CU-4 works.
6. Check that the **CU-4 used** check box is checked.
7. Select the item(s) to be calibrated.

   Note: ADC calibration has to be performed before other item(s). However, if all calibrations are selected at the same time, there is no need to perform the ADC calibration first.

8. Click **Calibrate**.

   The calibration of the selected item(s) is carried out automatically.

   The candidates for the new calibration values are shown in the *Calculated values* column. If the new calibration values seem to be acceptable (please refer to the following "Calibration value limits" table), click **Write** to store the new calibration values to the phone permanent memory.

Table 13 Calibration value limits

Parameter	Min.	Max.
ADC Offset	-20	20
ADC Gain	12000	14000
BSI Gain	1100	1300
VBAT Offset	2400	2650
VBAT Gain	19000	23000
VCHAR Gain	N/A	N/A
IBAT (ICal) Gain	7750	12250

9. Click **Read**, and confirm that the new calibration values are stored in the phone memory correctly. If the values are not stored to the phone memory, click **Write** and/or repeat the procedure again.
10. To end the procedure, close the *Energy Management Calibration* window.

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4 — RF Troubleshooting and Manual Tuning Guide

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Introduction to RF troubleshooting

On the following pages you will find a step-by-step troubleshooting procedure and reference measurements at the relevant signal points. For functional descriptions, please refer to the System module section.

Notes on reference measurements

All measurements must be done using:

- spectrum analyser with a high-frequency high-impedance passive probe (LO-/reference frequencies and RF power levels)
- oscilloscope with a 10:1 probe (DC-voltages and low frequency signals)

Important: All measurements with an RF coupler must be performed in an RF shielded environment, or where there are no transmissions on the same frequencies. This may disturb sensitive receiver measurements.

Repairing this phone - important

The RF section of the phone is built around one RF ASIC. Before changing the RF ASIC, please make sure that supply voltages and serial communication coming from baseband to RF are OK.

Please note that the grounding of the FEM module is directly below the FEM module. Therefore, it is difficult to check or change the module.

Most RF semiconductors are static discharge sensitive! ESD protection must be taken care of during repair (ground straps and ESD soldering irons). The RF ASIC and FEM are moisture sensitive, so parts must be pre-baked prior to soldering.

In addition to key components, there are lot of discrete components (resistors, inductors and capacitors) which troubleshooting is done mainly by checking if the soldering of the component is done properly.

Capacitor can be checked for shorts and resistors for value by means of an ohmmeter, but be aware in-circuit measurements should be evaluated carefully.

Keep in mind that all measured voltages or RF levels depicted in the service manual are rough figures. Especially RF levels vary because of different measuring equipment or different grounding of the probe used.

When using an RF probe, use a pair of metallic tweezers to connect the probe ground to the PWB ground as close to the measurement point as possible. If measurements are performed in a product specific module jig, then “GND” pads should be used for the probe ground.

RF key components

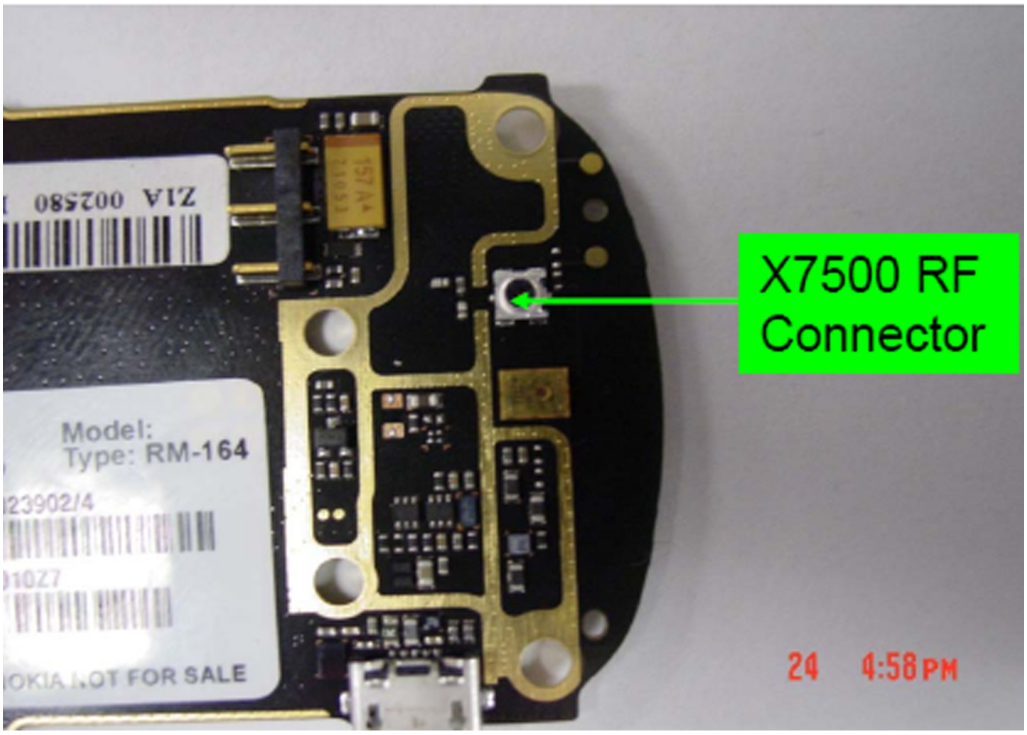

X7500 RF Connector
Model:
Type: RM-164
NOKIA NOT FOR SALE
24 4:58PM

Figure 16 RF key components, bottom side

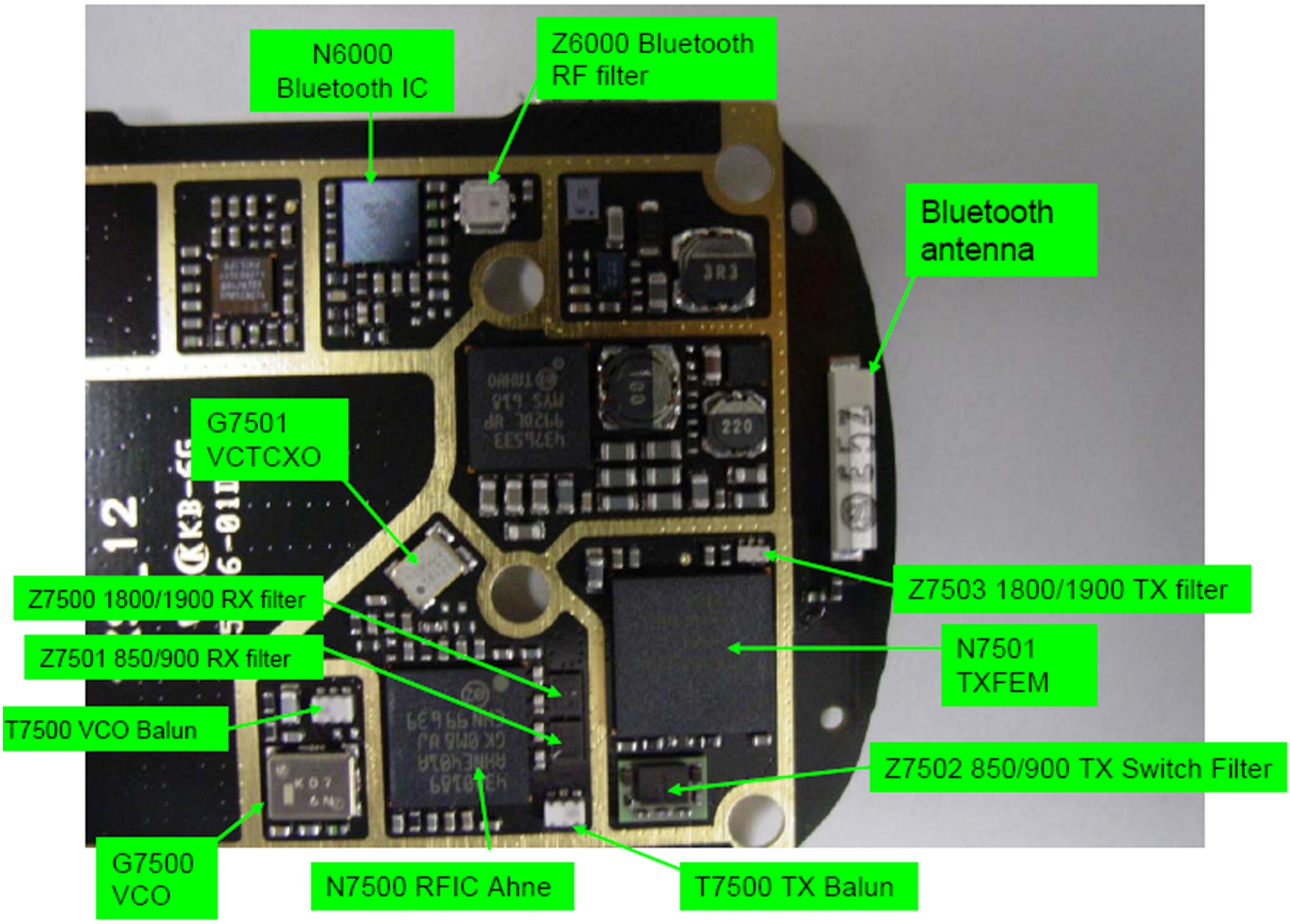

N6000
Bluetooth IC
Z6000 Bluetooth
RF filter
Bluetooth
antenna
G7501
VCTCXO
Z7503 1800/1900 TX filter
Z7500 1800/1900 RX filter
N7501
TXFEM
Z7501 850/900 RX filter
T7500 VCO Balun
Z7502 850/900 TX Switch Filter
G7500
VCO
N7500 RFIC Ahne
T7500 TX Balun

Figure 17 RF key components, top side

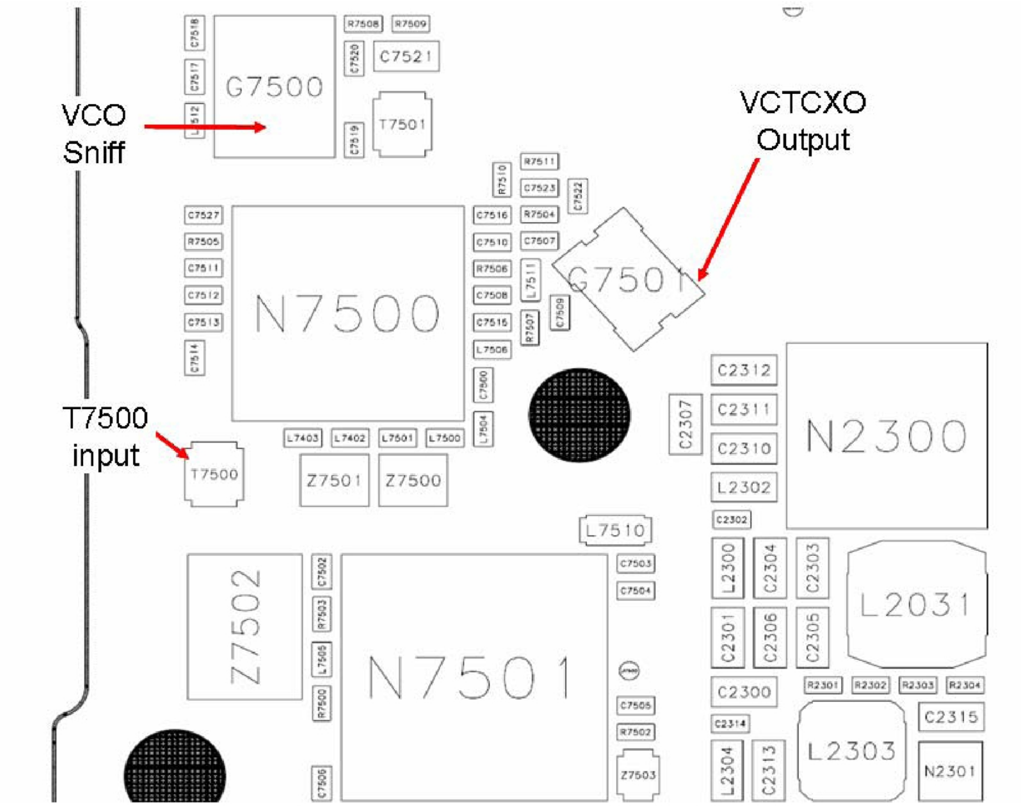

VCO Sniff
VCTCXO Output
T7500 input
G7500
T7501
N7500
G7501
T7500
Z7501
Z7500
N2300
L7510
Z7502
N7501
L2031
L2303
N2301
C2312
C2311
C2310
L2302
C2307
C2300
C2315
Z7503

Figure 18 Some RF test points

Receiver troubleshooting

Introduction to RX troubleshooting

Rx can be tested by making a phone call or in the local mode. For the local mode testing, use Phoenix service software.

The main Rx troubleshooting measurement is RSSI measurement. This test measures the signal strength of the received signal. I and Q branches can be measured separately.

In GSM, the input signal can be either a real GSM signal or a CW signal that is 67.771kHz up from the carrier frequency.

For service tool usage instructions, refer to section Service Tools and Service Concepts.

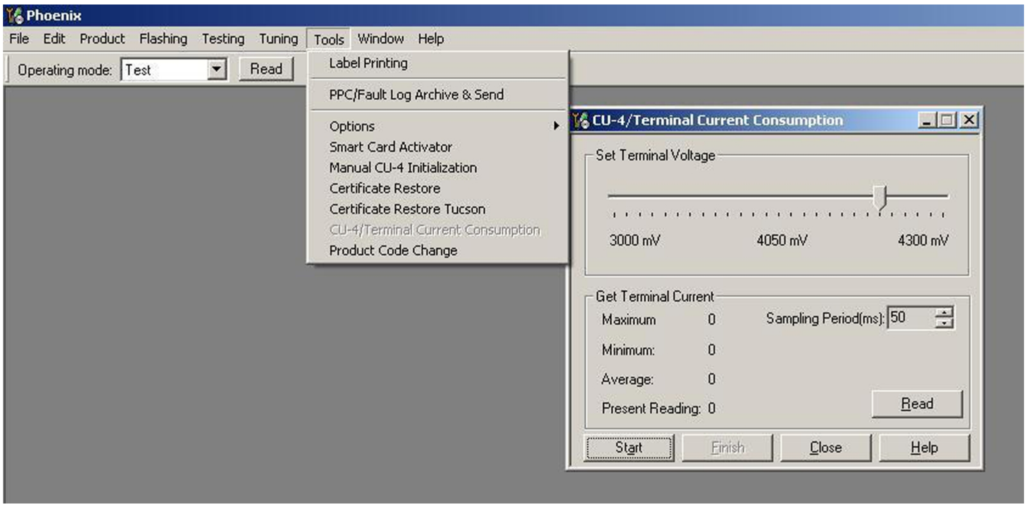
General instructions for RX troubleshooting

Steps

1. Connect a test jig to a computer with a FPS-10 flash prommer through F-Bus.

   Note: Make sure that you have a PKD-1 dongle connected to the computer's parallel port.

2. Connect test jig with DC supply voltage set to 4.0 V using Phoenix menu as shown next.


Phoenix
File Edit Product Flashing Testing Tuning Tools Window Help
Read
Label Printing
PPC/Fault Log Archive & Send
Options
Smart Card Activator
Manual CU-4 Initialization
Certificate Restore
Certificate Restore Tucson
CU-4/Terminal Current Consumption
Product Code Change
CU-4/Terminal Current Consumption
Set Terminal Voltage
3000 mV
4050 mV
4300 mV
Get Terminal Current
Read
Start
Finish
Close
Help

Operating mode: Test

Maximum 0

Minimum: 0

Average: 0

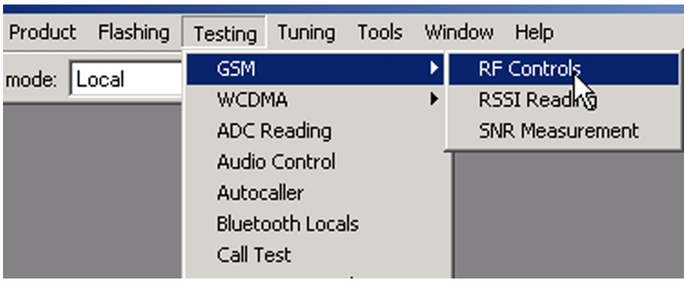
Present Reading: 0

Sampling Period(ms): 50

3. Connect an RF cable between the RF connector of the module test jig and measurement equipment.

   Note: Make sure that all connections are made to the correct RF connector.

4. Set Rx on.
   - i Set the phone module to the test jig and start *Phoenix service software*.
   - ii Initialize connection to the phone. (With the FPS-10 prommer use FPS10_USB or FPS10_TCP drivers, depending on connection type. When using DAU-9S select FBUS).
   - iii From the File menu, choose product: **File -> Choose Product -> xx-x*** (* = type designator of the phone, eg. RM-164), or press **Ctrl + R** to scan product.
   - iv From the toolbar, set operating mode to “Local”.
5. EGSM850/900/1800/1900 troubleshooting
   - i From the Testing menu, activate the *RF Controls* window: **Testing -> GSM -> RF Controls**.


Product Flashing Testing Tuning Tools Window Help
GSM
WCDMA
ADC Reading
Audio Control
Autocaller
Bluetooth Locals
Call Test
RF Controls
RSSI Reading
SNR Measurement

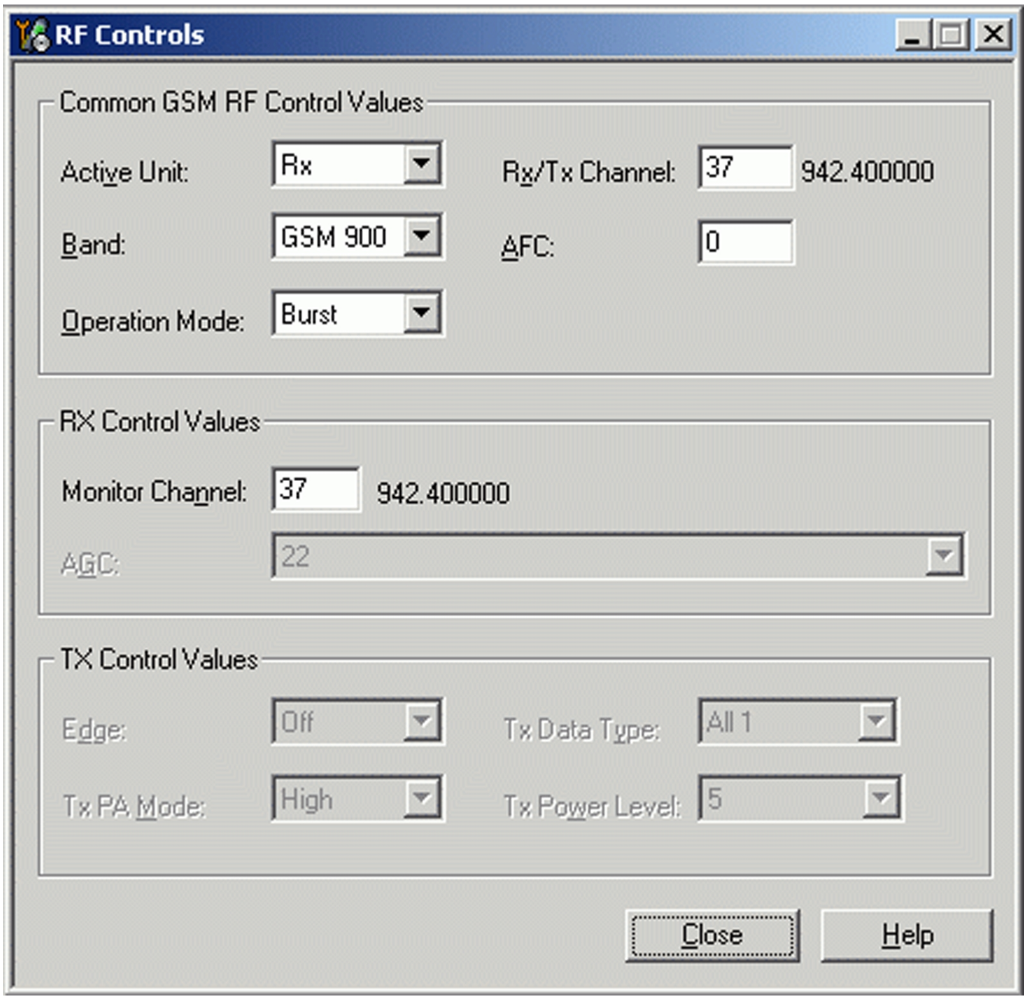
mode: Local

   - ii In the *RF Controls* window:
     - Select band (Default = “GSM850”).
     - Set Active unit to “Rx” (Default).
     - Set Operation mode to “Burst” (Default).
     - Set Rx/Tx channel (see table below).
     - Apply a frequency (see table below) to the RF-connector.

     Note: Remember to compensate for cable attenuation. You will find the values in the Service tools section.

     Apply a signal to the RF-connector. See values in the table below.

Band	Channel (RX and TX)	Input frequency (MHz)	Offset (kHz)	Power level (dBm)
GSM850	190	881.66771	67.710	-90
GSM900	37	942.46771	67.710	-90
GSM1800	700	1842.86771	67.710	-90
GSM1900	661	1960.06771	67.710	-90



RF Controls

Common GSM RF Control Values

Active Unit: Rx

Rx/Tx Channel: 37 942.400000

Band: GSM 900

AFC: 0

Operation Mode: Burst

RX Control Values

Monitor Channel: 37 942.400000

AGC: 22

TX Control Values

Edge: Off

Tx Data Type: All 1

Tx PA Mode: High

Tx Power Level: 5

Figure 19 RF Controls window

Receiver (RX) troubleshooting

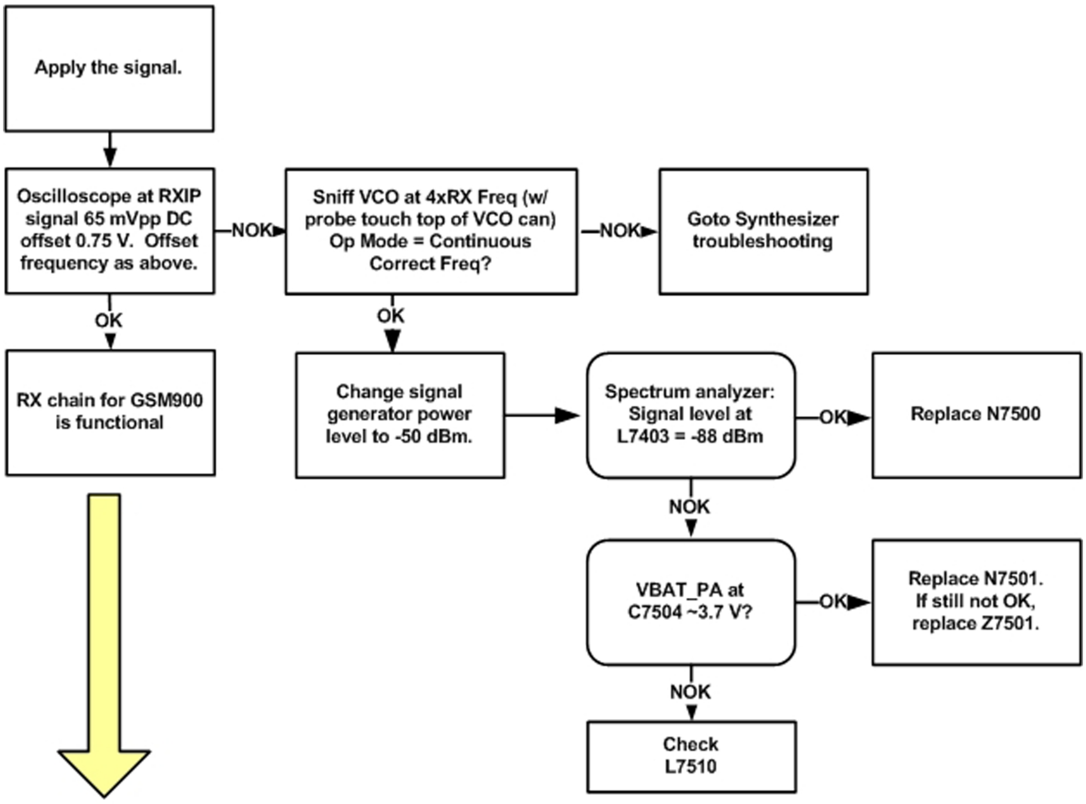
Context

Troubleshoot one band at a time. Start with GSM850 and end with GSM1900.

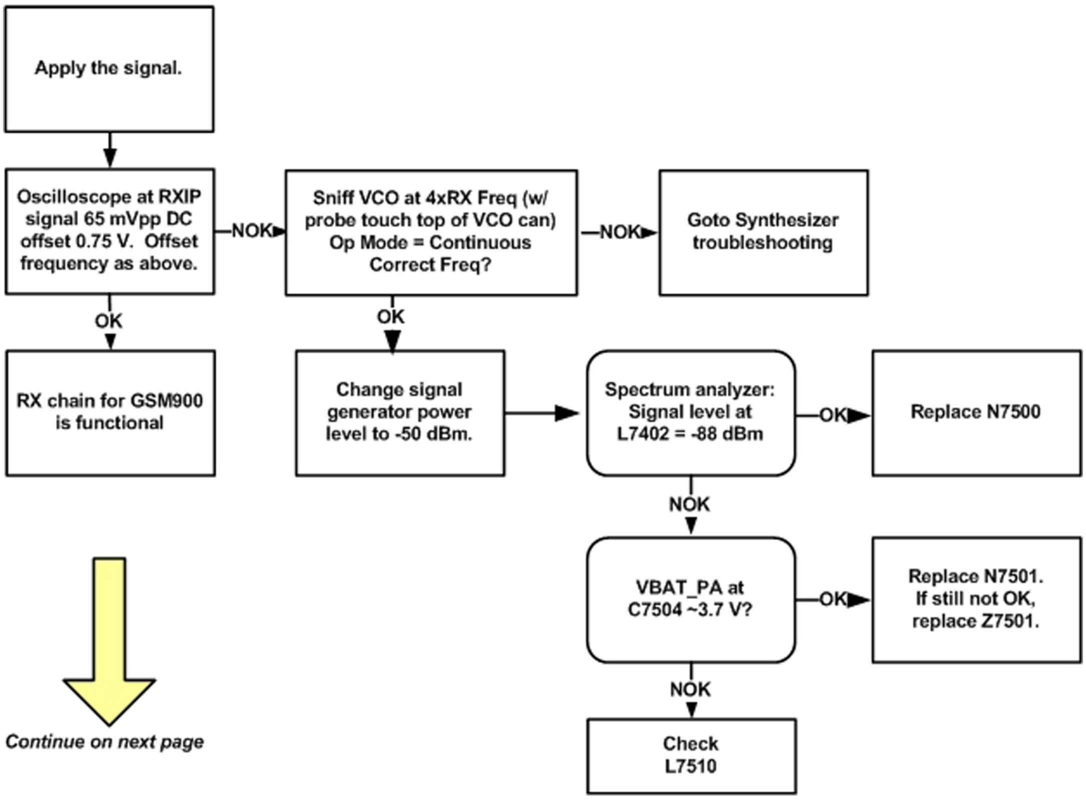
Troubleshooting flow

Apply a signal according to the table in General instructions for RX troubleshooting (page 4–8)

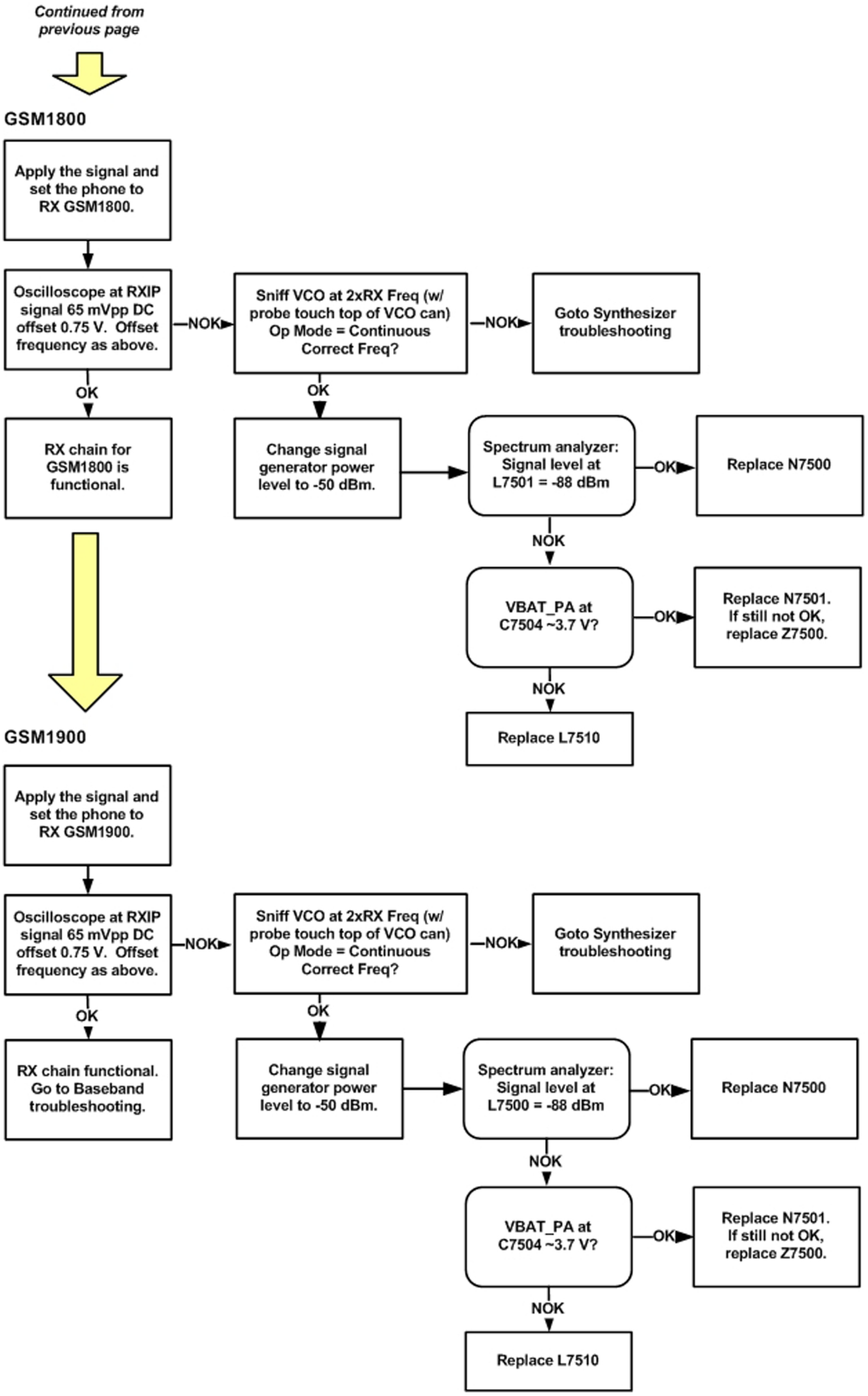
GSM850


Apply the signal.
Oscilloscope at RXIP signal 65 mVpp DC offset 0.75 V. Offset frequency as above.
NOK
Sniff VCO at 4xRX Freq (w/ probe touch top of VCO can) Op Mode = Continuous Correct Freq?
NOK
Goto Synthesizer troubleshooting
OK
RX chain for GSM900 is functional
OK
Change signal generator power level to -50 dBm.
Spectrum analyzer: Signal level at L7403 = -88 dBm
OK
Replace N7500
NOK
VBAT_PA at C7504 ~3.7 V?
OK
Replace N7501. If still not OK, replace Z7501.
NOK
Check L7510

GSM900


Apply the signal.
Oscilloscope at RXIP signal 65 mVpp DC offset 0.75 V. Offset frequency as above.
NOK
Sniff VCO at 4xRX Freq (w/ probe touch top of VCO can) Op Mode = Continuous Correct Freq?
NOK
Goto Synthesizer troubleshooting
OK
RX chain for GSM900 is functional
OK
Change signal generator power level to -50 dBm.
Spectrum analyzer: Signal level at L7402 = -88 dBm
OK
Replace N7500
NOK
VBAT_PA at C7504 ~3.7 V?
OK
Replace N7501. If still not OK, replace Z7501.
NOK
Check L7510

Continue on next page


Continued from previous page
GSM1800
Apply the signal and set the phone to RX GSM1800.
Oscilloscope at RXIP signal 65 mVpp DC offset 0.75 V. Offset frequency as above.
NOK
Sniff VCO at 2xRX Freq (w/ probe touch top of VCO can) Op Mode = Continuous Correct Freq?
NOK
Goto Synthesizer troubleshooting
OK
RX chain for GSM1800 is functional.
OK
Change signal generator power level to -50 dBm.
Spectrum analyzer: Signal level at L7501 = -88 dBm
OK
Replace N7500
NOK
VBAT_PA at C7504 ~3.7 V?
OK
Replace N7501. If still not OK, replace Z7500.
NOK
Replace L7510
GSM1900
Apply the signal and set the phone to RX GSM1900.
Oscilloscope at RXIP signal 65 mVpp DC offset 0.75 V. Offset frequency as above.
NOK
Sniff VCO at 2xRX Freq (w/ probe touch top of VCO can) Op Mode = Continuous Correct Freq?
NOK
Goto Synthesizer troubleshooting
OK
RX chain functional. Go to Baseband troubleshooting.
OK
Change signal generator power level to -50 dBm.
Spectrum analyzer: Signal level at L7500 = -88 dBm
OK
Replace N7500
NOK
VBAT_PA at C7504 ~3.7 V?
OK
Replace N7501. If still not OK, replace Z7500.
NOK
Replace L7510

GSM Rx chain activation for manual measurements / GSM RSSI measurement

Context

RSSI signal measurement is the main Rx troubleshooting measurement. The test measures the strength of the received signal.

I and Q branches can be measured separately. In GSM, the input signal can be either a real GSM signal or a CW (Continuous Wave) signal that is 67.771 kHz above the carrier frequency.

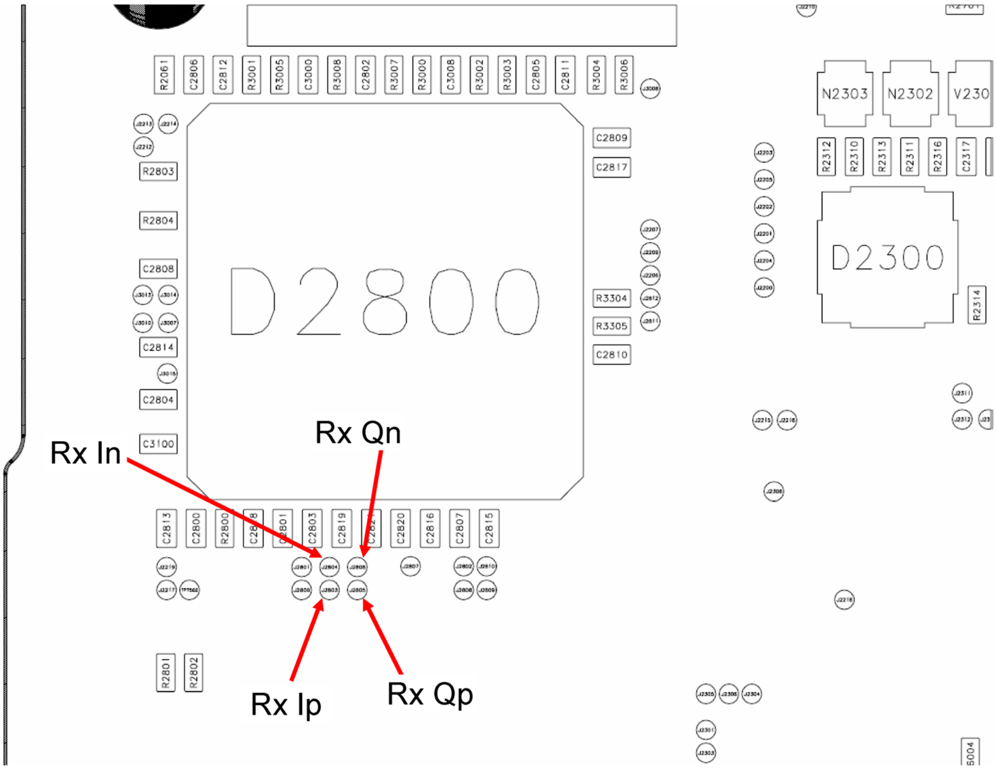

D2800
D2300
Rx In
Rx Qn
Rx Ip
Rx Qp
R2061
C2806
C2812
R3001
R3005
C3000
R3008
C2802
R3007
R3000
C3008
R3002
R3003
C2805
C2811
R3004
R3006
N2303
N2302
V230
R2312
R2310
R2313
R2311
R2316
C2317
R2803
R2804
C2808
C2814
C2804
C3100
C2809
C2817
R3304
R3305
C2810
R2314
C2813
C2800
C2803
C2819
C2820
C2816
C2807
C2815
R2801
R2802

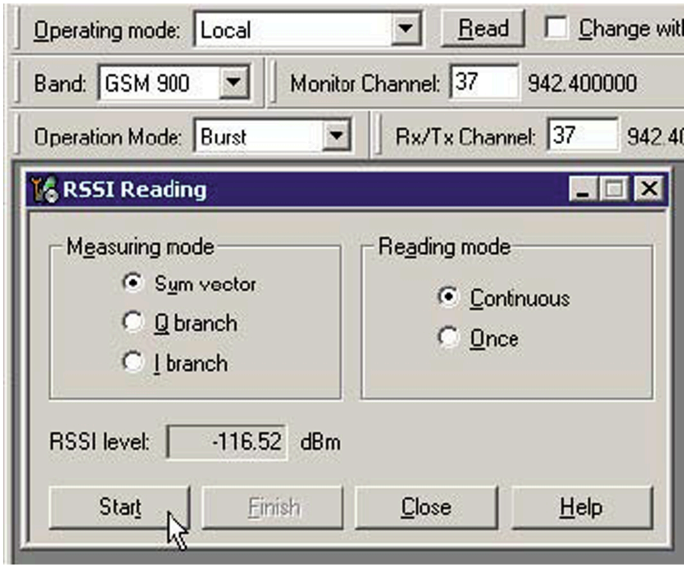
Figure 20 Rx IQ test points

Steps

1. Start *Phoenix* service software.
2. Choose **Testing→GSM→RSSI Reading** .
3. Set the RF signal generator for a channel frequency +67.771 kHz in CW mode.

   Alternatively set the cellular tester downlink channel to the appropriate channel. Make sure that the tester is set to continuous mode, not to burst mode.

4. In the *RSSI Reading* window, select the appropriate band and channel.



Operating mode: Local
Band: GSM 900
Monitor Channel: 37 942.400000
Operation Mode: Burst
Rx/Tx Channel: 37 942.4

RSSI Reading

Measuring mode: ● Sum vector ○ Q branch ○ I branch

Reading mode: ● Continuous ○ Once

RSSI level: -116.52 dBm

Figure 21 ***RSSI Reading*** **window**

5. To start the measurement, activate GSM Rx chain, click **Start**.

Results

RSSI reading values of the selected band and channel are displayed. The RSSI level must be the same value as that which is set at the signal generator (-90 dBm).

Transmitter troubleshooting

General instructions for TX troubleshooting

Context

- Tx troubleshooting requires Tx operation.
- Do not transmit on frequencies that are in use!
- Transmitter can be controlled in the local mode for diagnostic purposes.
- The most useful Phoenix tool for GSM transmitter testing is "RF Controls".
- Tx IQ tuning and Tx power tuning can be also used in some cases.
- Remember that retuning is not a fix! Phones are tuned correctly in production.

The first set of steps instructs how to assemble the test setup. This setup is general for all Tx troubleshooting tasks.

Alternative steps provide specific troubleshooting instructions for *Phoenix* service software.

> **Caution:** Never activate the GSM transmitter without a proper antenna load. There should be always 50 Ω load connected to the RF connector (antenna, RF-measurement equipment or at least 2 W dummy load), otherwise the GSM Power amplifier may be damaged.

Steps

1. Connect a test jig to a computer with FPS-10 flash prommer with a USB cable.

   Make sure that you have a PKD-1 dongle connected to the computer's parallel port.
2. Connect test jig with DC supply voltage set to 4V.

3. Connect an RF cable between the RF connector of the module test jig (MJ-133) and measurement equipment or alternatively use a 50 Ω (at least 2 W) dummy load in the module test jig RF connector, otherwise GSM may be damaged.

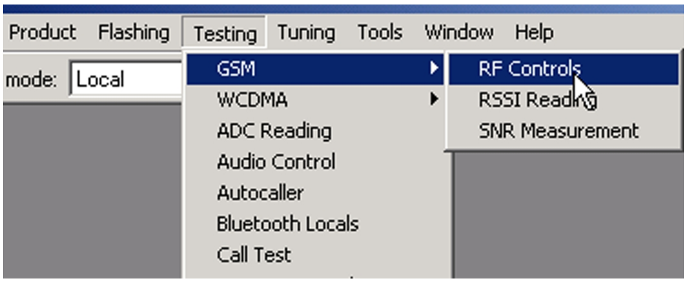
   Note: Make sure that all connections are made to the correct RF connector.

   Normally a spectrum analyser is used as measurement equipment.

   Note: The maximum input power of a spectrum analyser is +30 dBm.

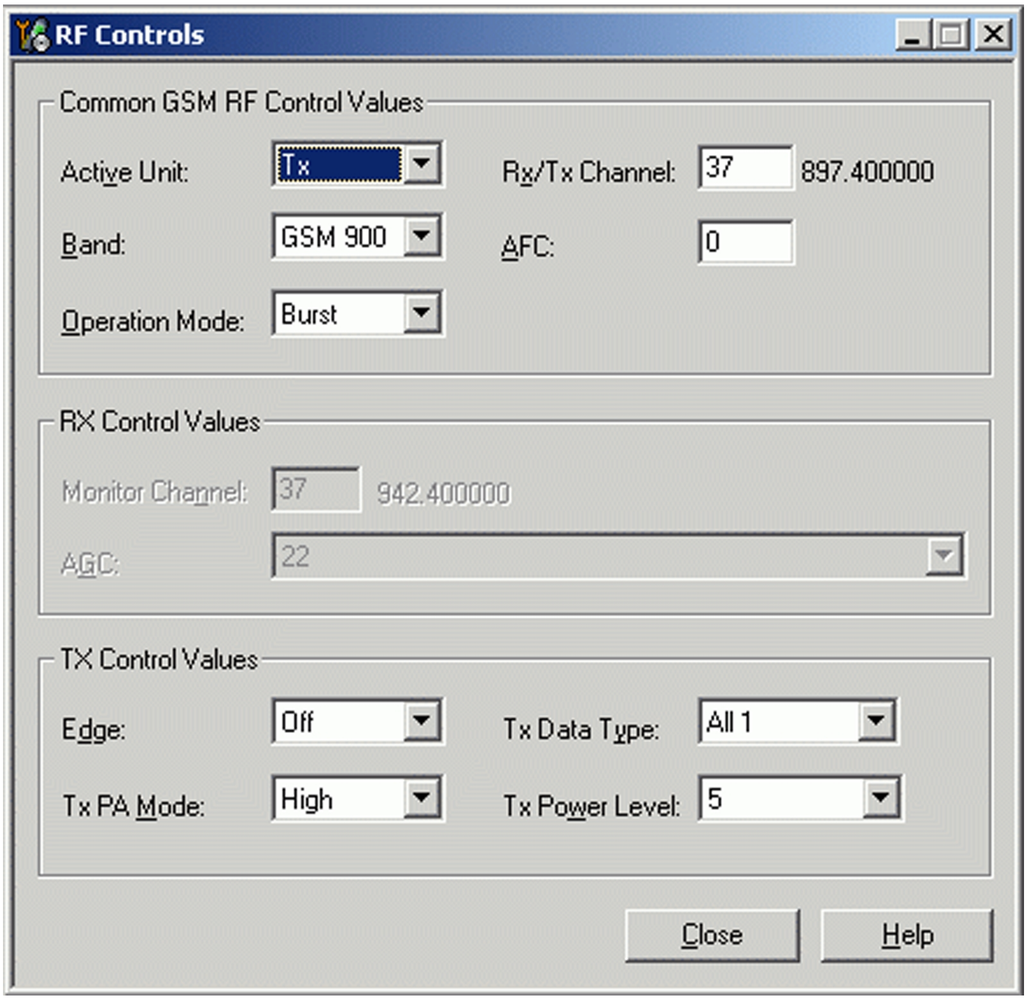
   To prevent any damage, it is recommended to use 10 dB attenuator on the spectrum analyzer input.

4. Set Tx on.
   - i Set the phone module to the test jig and start *Phoenix service software*.
   - ii Initialize connection to the phone. (With the FPS-10 prommer use FPS10_USB or FPS10_TCP drivers, depending on connection type. When using DAU-9S select FBUS driver).
   - iii From the File menu, choose product: **File -> Choose Product -> xx-x*** (* = type designator of the phone, RM-164), or press**Ctrl + R** to scan product.
   - iv From the toolbar, set operating mode to **Local**.
5. GSM850/900/1800/1900 troubleshooting
   - i From the Testing menu, activate the *RF Controls* window: **Testing -> GSM -> RF Controls** .


Product
Flashing
Testing
Tuning
Tools
Window
Help
mode:
Local
GSM
WCDMA
ADC Reading
Audio Control
Autocaller
Bluetooth Locals
Call Test
RF Controls
RSSI Reading
SNR Measurement

   - ii In the *RF Controls* window:
     - Select band **GSM850**, **GSM900** or **GSM1800** or **GSM1900** (Default = GSM850).
     - Set Active unit to **Tx** (Default = Rx).
     - Set Operation mode to **Burst** (Default).
     - Set Tx data type to **All1** (Default).
     - Set Rx/Tx channel (see table below)
     - Set Edge to **Off** (Default).
     - Set Tx PA mode to **High** (Default).
     - Set power level (see table below)

Band	Channel (RX and TX)	TX power level
GSM850	190	5
GSM900	37	5
GSM1800	700	0
GSM1900	661	0



Common GSM RF Control Values

Active Unit: Tx

Rx/Tx Channel: 37 897.400000

Band: GSM 900

AFC: 0

Operation Mode: Burst

RX Control Values

Monitor Channel: 37 942.400000

AGC: 22

TX Control Values

Edge: Off

Tx Data Type: All 1

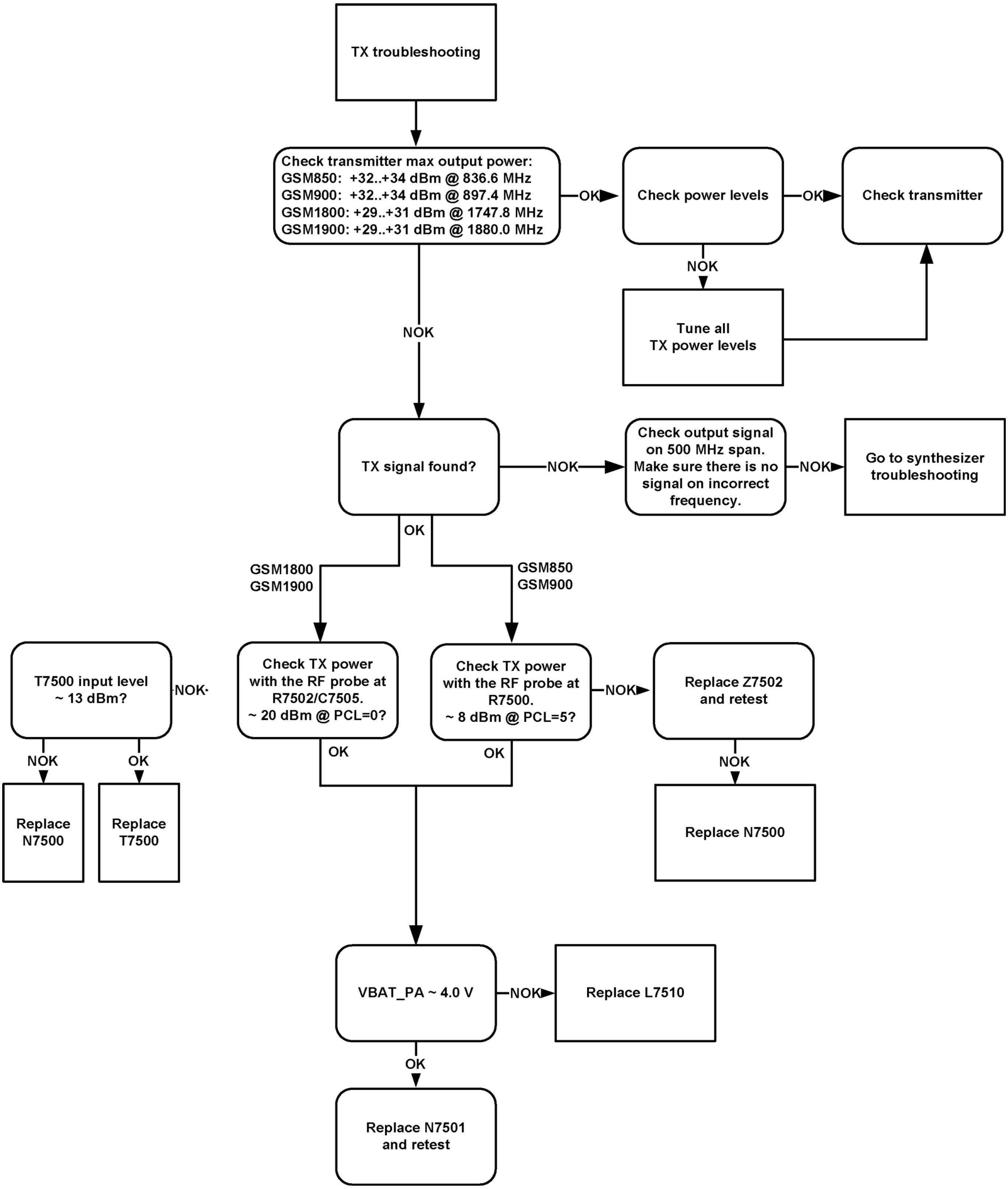
Tx PA Mode: High

Tx Power Level: 5

Figure 22 RF Controls window

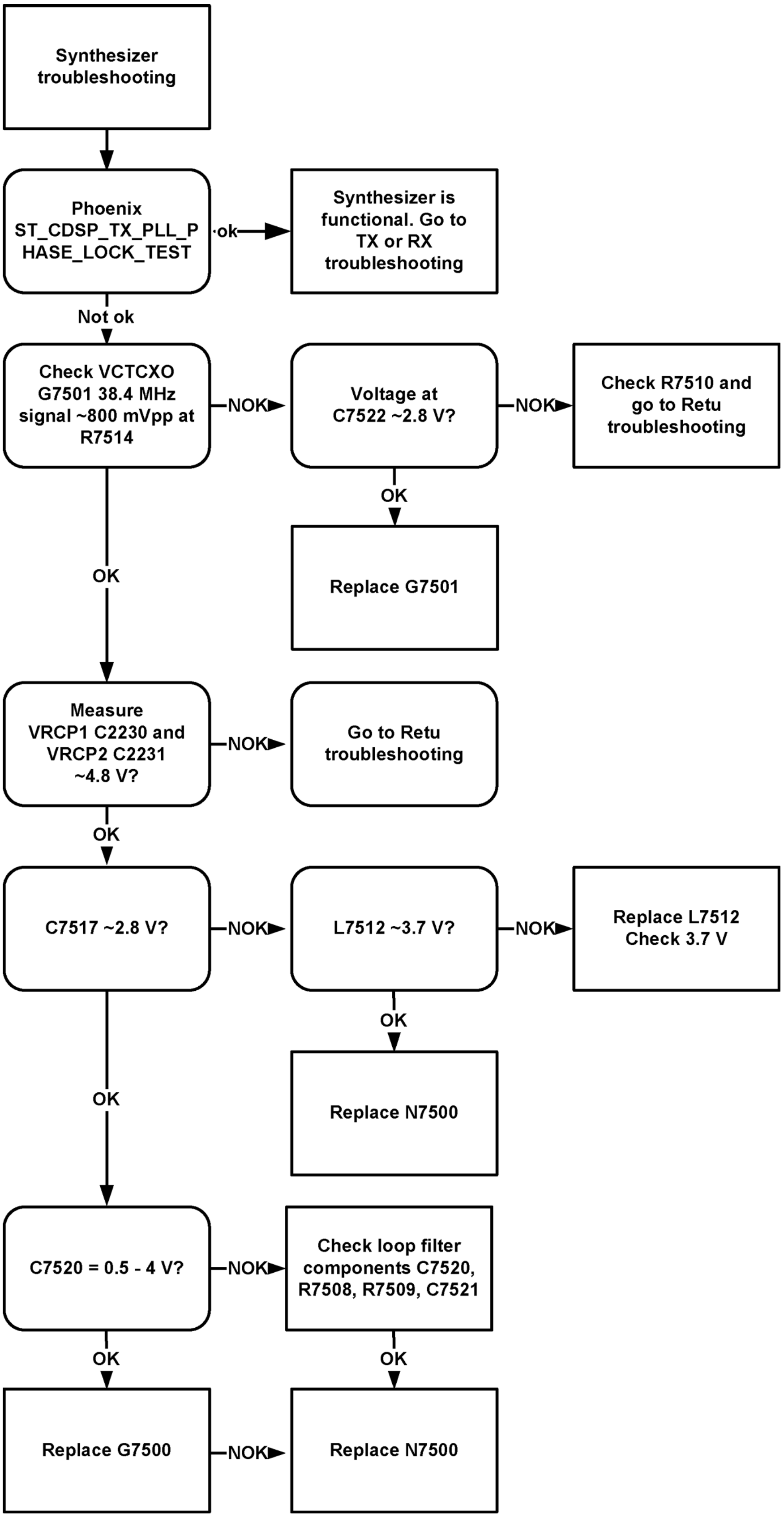
Transceiver (TX) troubleshooting

Troubleshooting flow


TX troubleshooting
Check transmitter max output power:
GSM850: +32..+34 dBm @ 836.6 MHz
GSM900: +32..+34 dBm @ 897.4 MHz
GSM1800: +29..+31 dBm @ 1747.8 MHz
GSM1900: +29..+31 dBm @ 1880.0 MHz
OK
Check power levels
OK
Check transmitter
NOK
Tune all TX power levels
NOK
TX signal found?
NOK
Check output signal on 500 MHz span. Make sure there is no signal on incorrect frequency.
NOK
Go to synthesizer troubleshooting
OK
GSM1800
GSM1900
GSM850
GSM900
T7500 input level ~ 13 dBm?
NOK
Check TX power with the RF probe at R7502/C7505. ~ 20 dBm @ PCL=0?
Check TX power with the RF probe at R7500. ~ 8 dBm @ PCL=5?
NOK
Replace Z7502 and retest
NOK
OK
Replace N7500
Replace T7500
OK
OK
NOK
Replace N7500
VBAT_PA ~ 4.0 V
NOK
Replace L7510
OK
Replace N7501 and retest

Synthesizer troubleshooting

Synthesizer troubleshooting


Synthesizer troubleshooting
Phoenix ST_CDSP_TX_PLL_PHASE_LOCK_TEST
ok
Synthesizer is functional. Go to TX or RX troubleshooting
Not ok
Check VCTCXO G7501 38.4 MHz signal ~800 mVpp at R7514
NOK
Voltage at C7522 ~2.8 V?
NOK
Check R7510 and go to Retu troubleshooting
OK
Replace G7501
OK
Measure VRCP1 C2230 and VRCP2 C2231 ~4.8 V?
NOK
Go to Retu troubleshooting
OK
C7517 ~2.8 V?
NOK
L7512 ~3.7 V?
NOK
Replace L7512 Check 3.7 V
OK
Replace N7500
OK
C7520 = 0.5 - 4 V?
NOK
Check loop filter components C7520, R7508, R7509, C7521
OK
OK
Replace G7500
NOK
Replace N7500

RF tunings

Introduction to RF tunings

Important: Only perform RF tunings if:

- one or more of the RF components have been replaced
- flash memory chip is replaced or corrupted.

RF calibration is always performed with the help of a product-specific module jig (MJ-133), never with an RF coupler. Using an RF coupler in the calibration phase will cause a complete mistuning of the RF part.

Important: After RF component replacements, **always** use autotuning. Manual tunings are only required in rare cases.

Cable and adapter losses

RF cables and adapters have some losses. They have to be taken into account when the phone is tuned. As all RF losses are frequency dependent, the user has to act very carefully and understand the measurement setup.

For RF attenuations of the module jig, please refer to the Service tools section.

Auto tuning for BB5.0

This phone can be tuned automatically.

Autotune is designed to align the phone's RF part easier and faster. It performs calibrations, tunings and measurements of RX and TX. The results are displayed and logged in a result file, if initiated.

Hardware set up

Hardware requirements for auto tuning:

- PC (Windows 2000/XP) with GPIB card
- Power supply
- Product specific module jig
- Cables: XRF-1 (RF cable), USB cable, GBIP cable and DAU-9S
- Signal analyser (TX), signal generator (RX) and RF-splitter *or* one device including all.

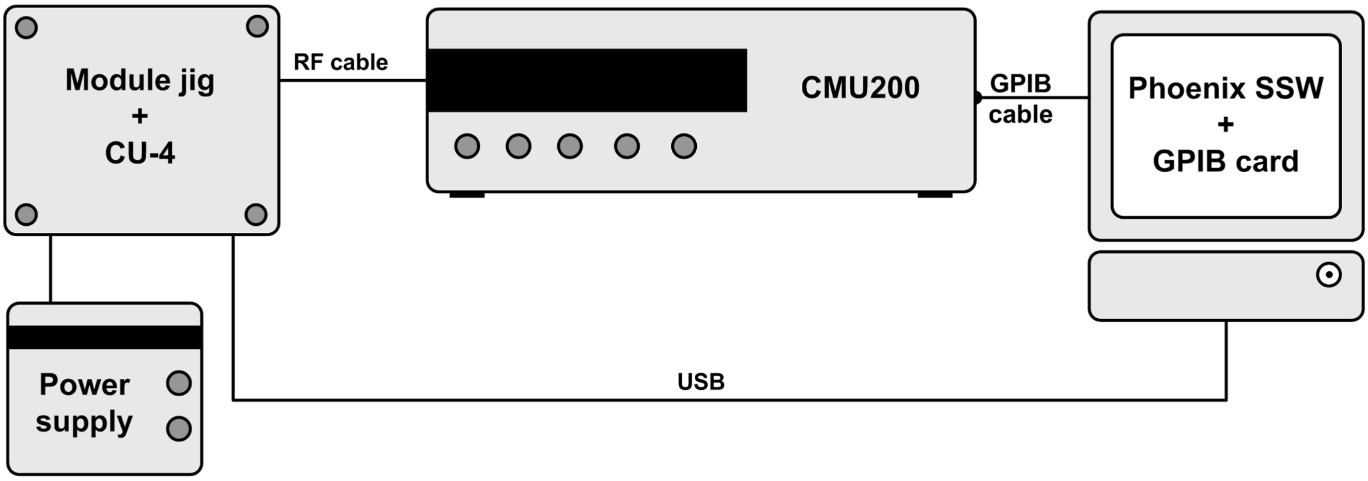


Figure 23 Auto tuning concept with CMU200

Phoenix preparations

Install the phone specific data package, for example *RM-164_dp_1.78_sw_sh3.26.exe*. This defines phone specific settings..

Auto tuning procedure

1 Make sure the phone (in the jig) is connected to the equipment. Else, some menus will not be shown in Phoenix.
2 To go to autotune, select *Tuning (Alt-U)* > *Auto-Tune (Alt-A)* from the menu.
3 Start autotuning, clicking the *Tune* button.

System mode independent manual tunings

RF channel filter calibration

Context

Rf channel filter calibration tunes the internal low pass filters of the RF ASIC, that limit the bandwidth of BB IQ signals.

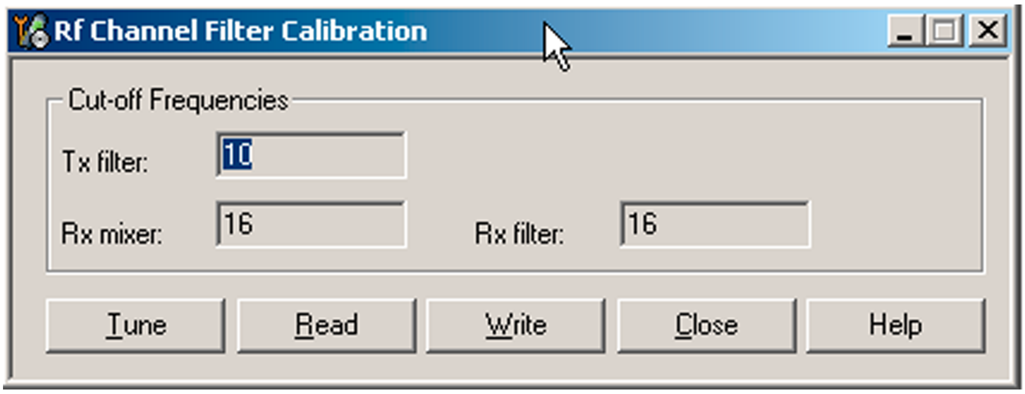
Table 14 Rf channel filter calibration tuning limits

	Min	Typ	Max
Tx filter	0	10	31
RX mixer	0	13	31
Rx filter	0	16	31

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning→Rf Channel Filter Calibration** .
3. Click **Tune**.
4. To save the values to the PMM (Phone Permanent Memory) area, click **Write**.
5. To close the *Rf Channel Filter Calibration* window, click **Close**.

Results



Tx filter: 10

Rx mixer: 16

Rx filter: 16

Figure 24 Rf channel filter calibration typical values

PA (power amplifier) detection

Context

The PA detection procedure detects which PA manufacturer is used for phone PAs.

If a PA is changed or if the permanent memory (PMM) data is corrupted, PA detection has to be performed before Tx tunings.

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning**→**PA Detection** .
3. Click **Tune**.
4. Check that the detected PA manufacturers are corresponding to the actual chips on the board.
5. To end the procedure, click **Close**.

■ GSM receiver tunings

Rx calibration (GSM)

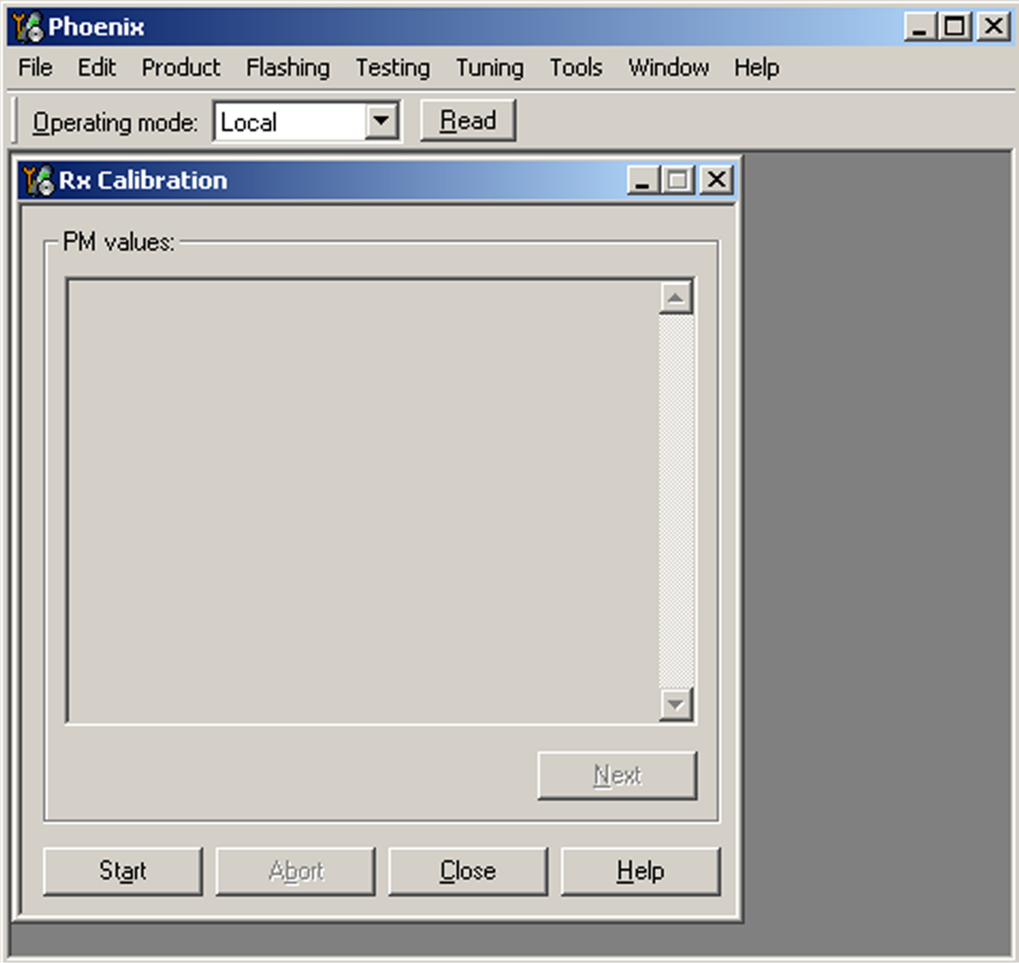
Context

Rx Calibration is used to find out the real gain values of the GSM Rx AGC system and tuning response of the AFC system (AFC D/A init value and AFC slope)

Steps

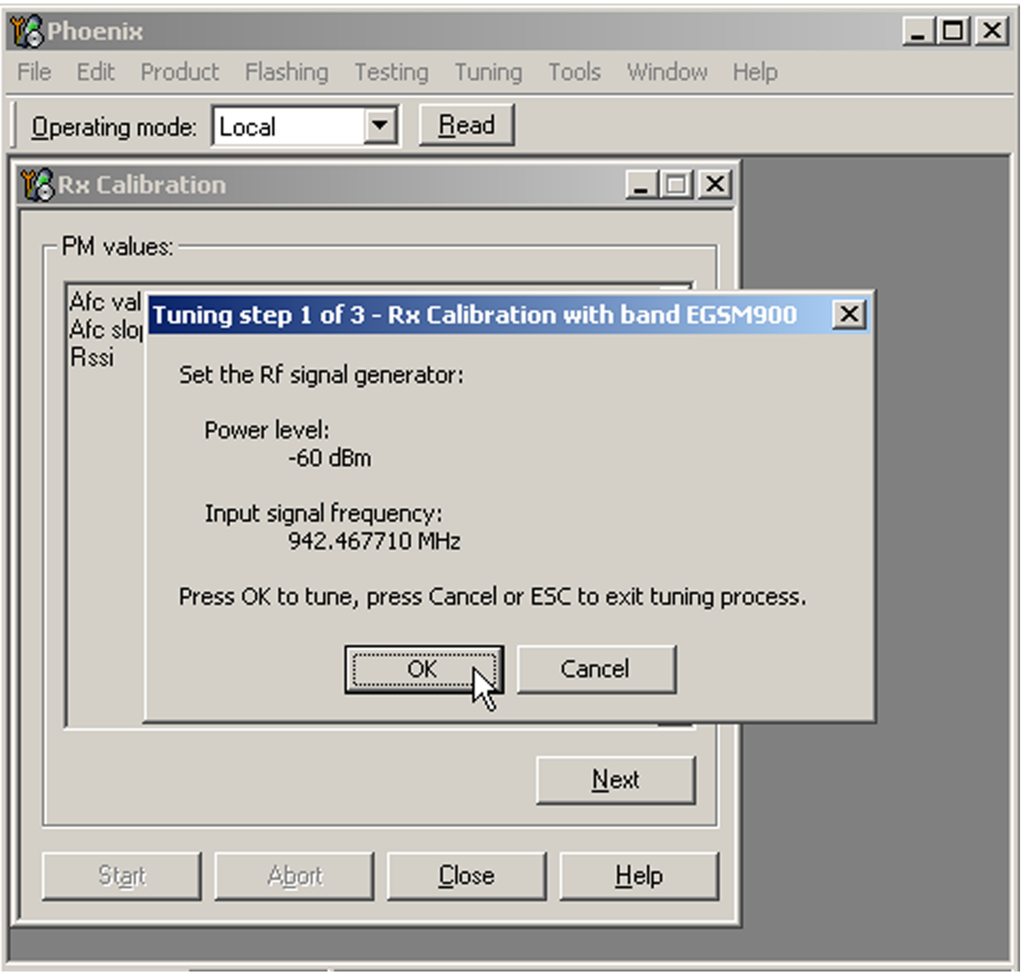
1. Connect the GSM connector of the module jig to a signal generator.
2. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Choose **Tuning**→**GSM**→**Rx Calibration** .

5. Click **Start**.


Phoenix
File Edit Product Flashing Testing Tuning Tools Window Help
Operating mode: Local
Read
Rx Calibration
PM values:
Next
Start
Abort
Close
Help

6. Connect the signal generator to the phone, and set frequency and amplitude as instructed in the **Rx Calibration with band EGSM900** (step 1-3) pop-up window.

   Important: The calibration uses a non-modulated CW signal. Increase the signal generator level by cable attenuation and module jig probe attenuation.


Phoenix
File
Edit
Product
Flashing
Testing
Tuning
Tools
Window
Help
Operating mode:
Local
Read
Rx Calibration
PM values:
Afc val
Afc slo
Rssi
OK
Cancel
Next
Start
Abort
Close
Help

Tuning step 1 of 3 - Rx Calibration with band EGSM900

Set the Rf signal generator:

Power level:
-60 dBm

Input signal frequency:
942.467710 MHz

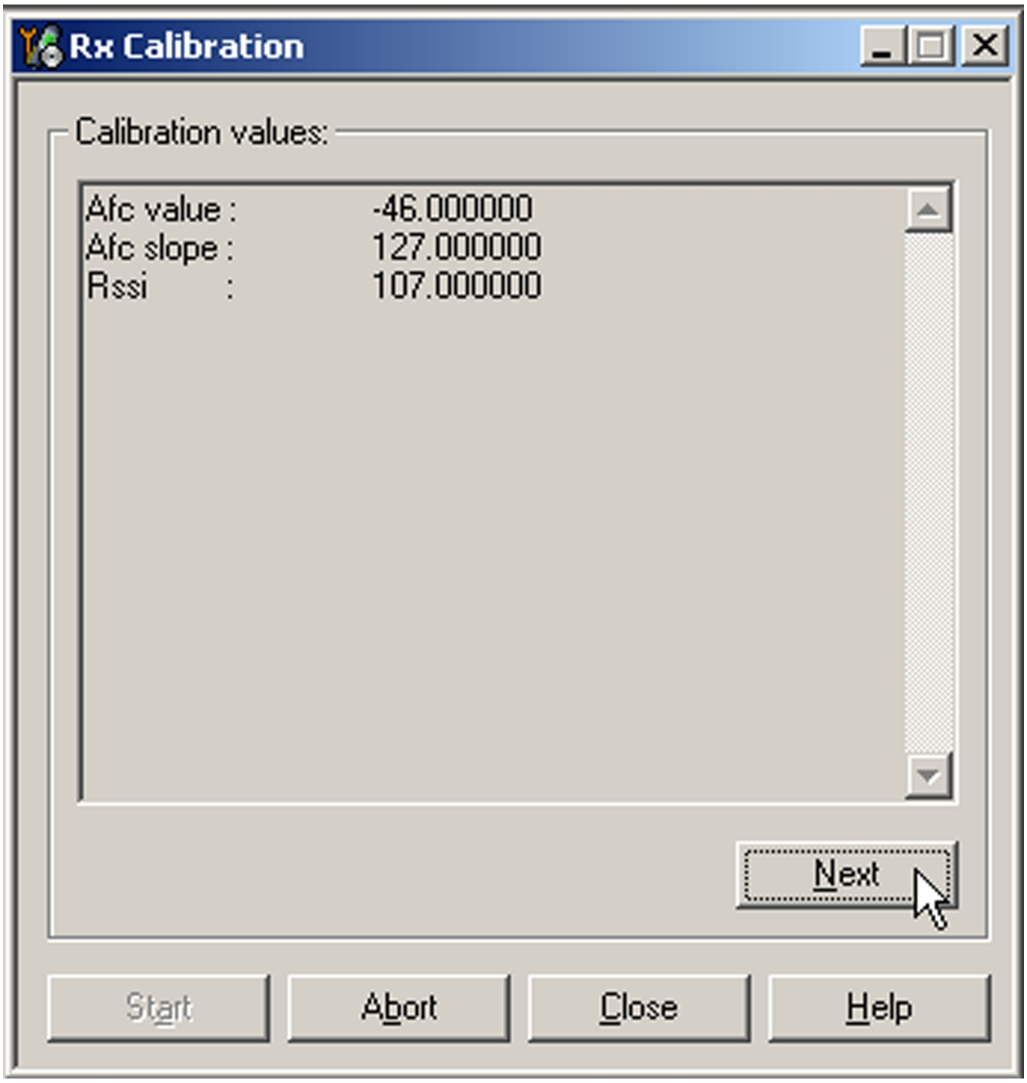
Press OK to tune, press Cancel or ESC to exit tuning process.

7. To perform the tuning, click **OK**.
8. Check that the tuning values are within the limits specified in the following table:

Table 15 RF tuning limits in Rx calibration

	Min	Typ	Max	Unit
GSM850				
AFC Value (init)	-200	-80..40	200	dB
AFC slope	0	108..121	200	dB
RSSI (AGC-0)	106	107..110	114	dB
GSM900				
AFC Value (init)	-200	-105..62	200	dB
AFC slope	0	122	200	dB
RSSI (AGC-0)	106	107...110	114	dB
GSM1800				
RSSI (AGC-0)	105	105...109	114	dB
GSM1900				
RSSI (AGC-0)	105	105...109	114	dB

9. Click **Next** to continue with GSM1800 Rx tuning.



Afc value : -46.000000
Afc slope : 127.000000
Rssi : 107.000000

Next actions

Repeat steps 6 to 9for GSM1800 and GSM1900

Rx band filter response compensation (GSM)

Prerequisites

Rx calibration must be performed before the Rx band filter response compensation.

Context

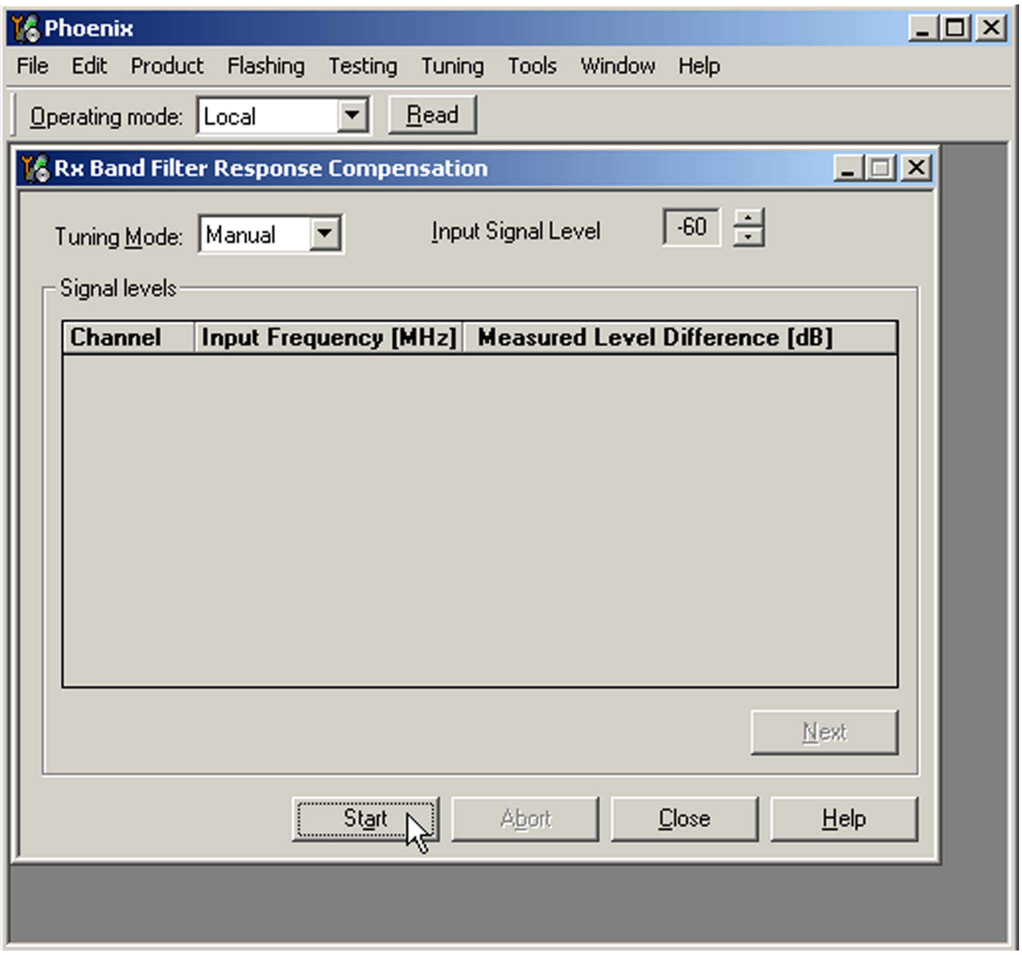
On each GSM Rx band, there is a band filter in front of the RF ASIC front end. The amplitude ripple caused by these filters causes ripple to the RSSI measurement, and therefore calibration is needed.

The calibration has to be repeated for each GSM band.

Steps

1. Connect the GSM connector of the module jig to a signal generator.
2. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.

4. Select **GSM900** band.
5. Choose **Tuning→GSM→Rx Band Filter Response Compensation** .
6. Select **Tuning mode: manual**
7. Click **Start**.


Phoenix
File
Edit
Product
Flashing
Testing
Tuning
Tools
Window
Help
Read
Rx Band Filter Response Compensation
Next
Start
Abort
Close
Help

Operating mode: Local

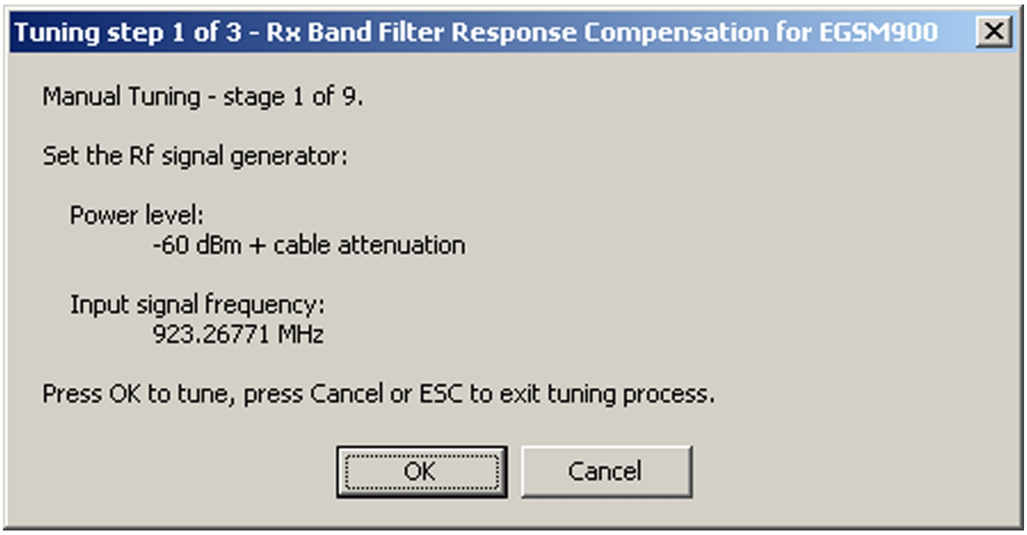
Tuning Mode: Manual

Input Signal Level -60

Signal levels

Channel	Input Frequency [MHz]	Measured Level Difference [dB]

8. Connect the signal generator to the phone, and set frequency and amplitude as instructed in the *Rx Band Filter Response Compensation for EGSM900* pop-up window, step 1-3.


Tuning step 1 of 3 - Rx Band Filter Response Compensation for EGSM900
OK
Cancel

Manual Tuning - stage 1 of 9.

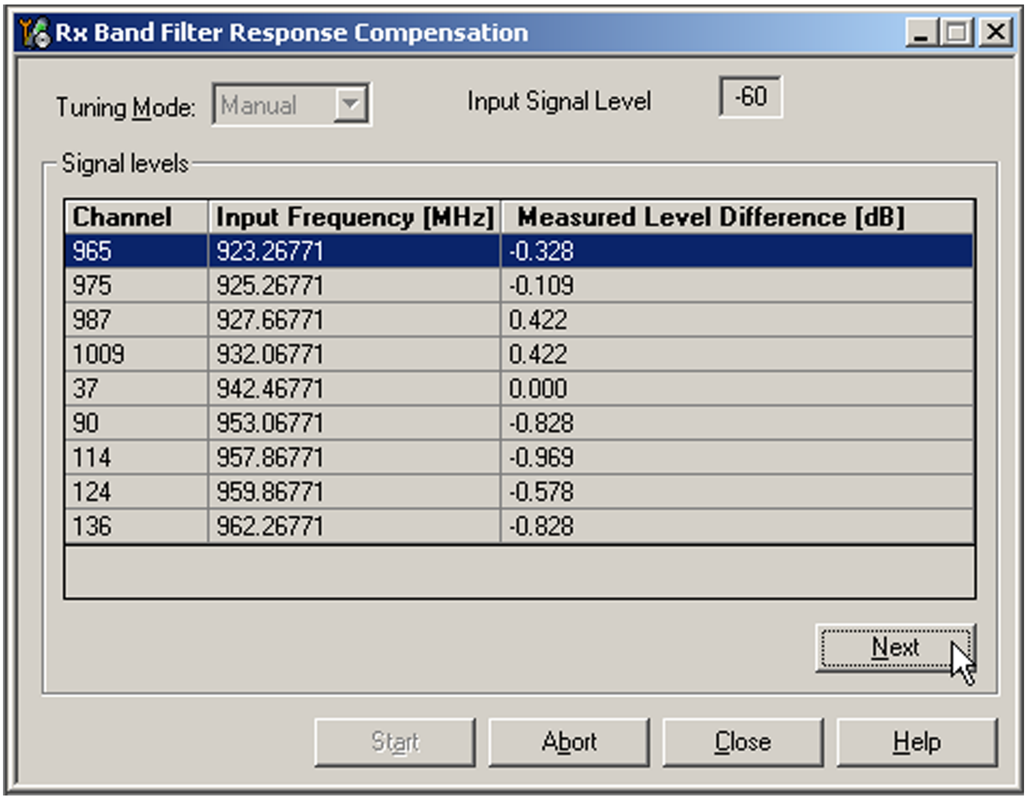
Set the Rf signal generator:

Power level:
-60 dBm + cable attenuation

Input signal frequency:
923.26771 MHz

Press OK to tune, press Cancel or ESC to exit tuning process.

9. To perform tuning, click **OK**.
10. Go through all 9 frequencies. The following table will be shown:



Tuning Mode: Manual

Input Signal Level -60

Channel	Input Frequency [MHz]	Measured Level Difference [dB]
965	923.26771	-0.328
975	925.26771	-0.109
987	927.66771	0.422
1009	932.06771	0.422
37	942.46771	0.000
90	953.06771	-0.828
114	957.86771	-0.969
124	959.86771	-0.578
136	962.26771	-0.828

11. Check that the tuning values are within the limits specified in the following table:

	Min	Typ	Max	Unit
GSM850				
Ch. 118/867.26771 MHz	-6	-1	2	dB
Ch. 128/869.26771 MHz	-3	0	2	dB
Ch. 140/871.66771 MHz	-3	0	2	dB
Ch. 172/878.06771 MHz	-2	0	2	dB
Ch. 190/881.66771 MHz	-2	0	2	dB
Ch. 217 / 887.06771 MHz	-2	0	2	dB
Ch. 241/891.86771 MHz	-3	0	2	dB
Ch. 251/893.86771 MHz	-3	0	2	dB
Ch. 261/895.86771 MHz	-6	-1	-2	dB
GSM900				
Ch. 965 / 923.26771 MHz	-6	-1	2	dB
Ch. 975 / 925.26771 MHz	-3	0	2	dB
Ch. 987 / 927.66771 MHz	-3	0	2	dB
Ch. 1009 / 932.06771 MHz	-2	0	2	dB

	Min	Typ	Max	Unit
Ch. 37 / 942.46771 MHz	-2	0	2	dB
Ch. 90 / 953.06771 MHz	-2	0	2	dB
Ch. 114 / 957.86771 MHz	-3	0	2	dB
Ch. 124 / 959.86771 MHz	-3	0	2	dB
Ch. 136 / 962.26771 MHz	-6	-1	2	dB
GSM1800				
Ch. 497 / 1802.26771 MHz	-6	-1	3	dB
Ch. 512 / 1805.26771 MHz	-3	0	3	dB
Ch. 535 / 1809.86771 MHz	-3	0	3	dB
Ch. 606 / 1824.06771 MHz	-3	0	3	dB
Ch. 700 / 1842.86771 MHz	-3	0	3	dB
Ch. 791 / 1861.06771 MHz	-3	0	3	dB
Ch. 870 / 1876.86771 MHz	-3	0	3	dB
Ch. 885 / 1879.86771 MHz	-3	0	3	dB
Ch. 908 / 1884.46771 MHz	-6	-1	3	dB
GSM1900				
Ch. 496 / 1927.06771 MHz	-6	-1	2	dB
Ch. 512 / 1930.26771 MHz	-3	0	2	dB
Ch. 537 / 1935.26771 MHz	-3	0	2	dB
Ch. 586 / 1945.06771 MHz	-3	0	2	dB
Ch. 661 / 1960.06771 MHz	-3	0	2	dB
Ch. 736 / 1975.06771 MHz	-3	0	2	dB
Ch. 794 / 1986.66771 MHz	-3	0	2	dB
Ch. 810 / 1989.86771 MHz	-3	0	2	dB
Ch. 835 / 1994.86771 MHz	-6	-1	2	dB

12. If the values are within the limits, click **Next** to continue to the next band.

Next actions

Repeat the steps 8 to 12 for GSM1800 and GSM1900.

GSM transmitter tunings

Tx IQ tuning (GSM)

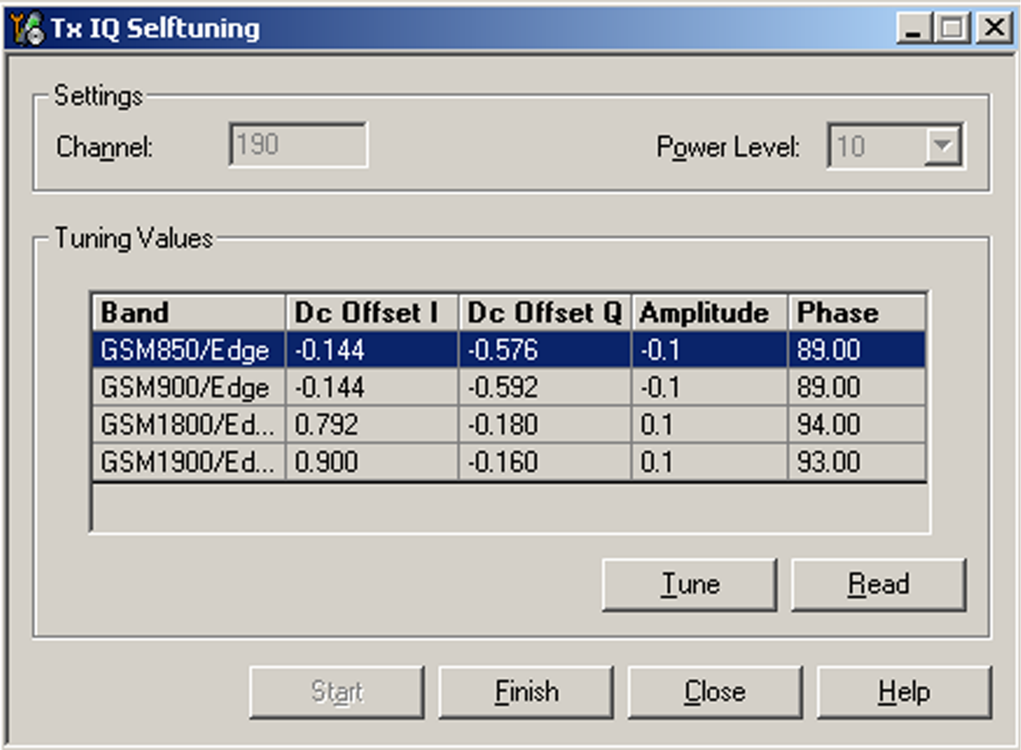
Context

The Tx path branches to I and Q signals at RF I/Q modulator. Modulator and analog hardware located after it cause unequal amplitude and phase disturbance to I and Q signal paths. Tx IQ tuning balances the I and Q branches.

Tx IQ tuning must be performed for all GSM bands.

Steps

1. Start *Phoenix* service software.
2. From the **Operating mode** drop-down menu, set mode to **Local**.
3. Choose **Tuning→GSM→Tx IQ Tuning** .
4. Select **Mode: Automatic**.



Channel: 190

Power Level: 10

Band	Dc Offset I	Dc Offset Q	Amplitude	Phase
GSM850/Edge	-0.144	-0.576	-0.1	89.00
GSM900/Edge	-0.144	-0.592	-0.1	89.00
GSM1800/Ed...	0.792	-0.180	0.1	94.00
GSM1900/Ed...	0.900	-0.160	0.1	93.00

5. Select **Band: GSM900** and click **Start**.
6. Click **Next** to start GSM1800 band TX IQ tuning.
7. Click **Next** to start GSM1900 band TX IQ tuning.
8. Click**Finish** and then **Close**.

Next actions

Tuning sliders should be close to the center of the scale after the tuning and within the limits specified in the following table. If they are not within the limits, check Tx IQ quality manually.

	Min	Typ	Max	Unit
GSM850				
I DC offset / Q DC offset	-6	-4	6	%
Ampl	-1	0	1	dB
Phase	85	90	95	°
GSM900				

	Min	Typ	Max	Unit
I DC offset / Q DC offset	-6	-4	6	%
Ampl	-1	0	1	dB
Phase	85	90	95	°
GSM1800/GSM1900				
I/Q DC	-6	0.5	6	%
Ampl	-1	0	1	dB
Phase	95	100	110	°

Tx power level tuning (GSM)

Context

Because of variations at the IC (Integrated Circuit) process and discrete component values, the actual transmitter RF gain of each phone is different. Tx power level tuning is used to find out mapping factors called 'power coefficients'. These adjust the GSM transmitter output power to fulfill the specifications.

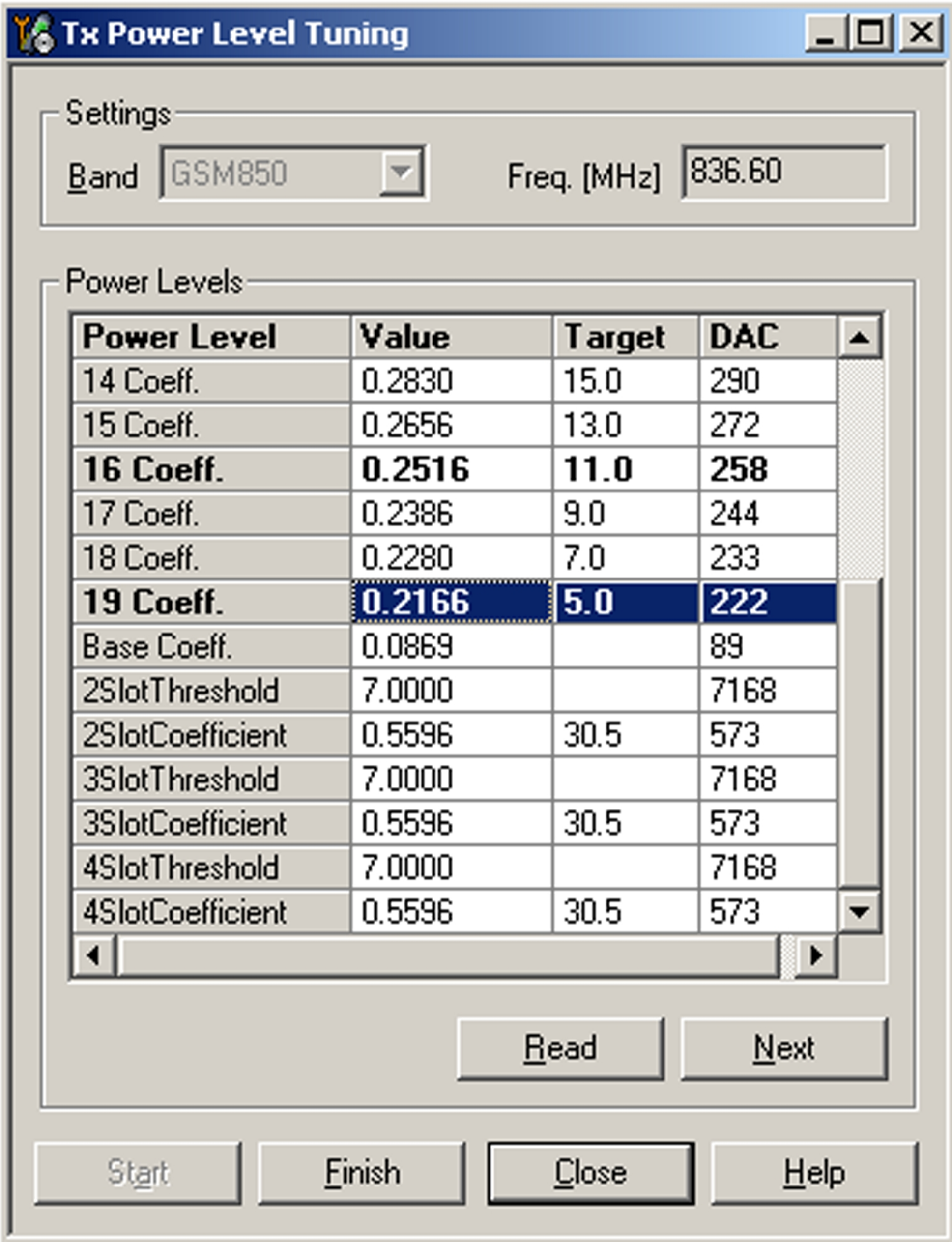
For EDGE transmission, the bias settings of the GSM PA are adjusted in order to improve linearity. This affects the PA gain and hence the power levels have to be aligned separately for EDGE transmission.

Tx power level tuning has to be performed on all GSM bands.

Steps

1. Connect the phone to a spectrum analyzer.
2. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Choose **Tuning→GSM→Tx Power Level Tuning** .

5. Click **Start.**l



Settings

Band: GSM850

Freq. [MHz]: 836.60

Power Levels

Power Level	Value	Target	DAC
14 Coeff.	0.2830	15.0	290
15 Coeff.	0.2656	13.0	272
16 Coeff.	**0.2516**	**11.0**	**258**
17 Coeff.	0.2386	9.0	244
18 Coeff.	0.2280	7.0	233
19 Coeff.	**0.2166**	**5.0**	**222**
Base Coeff.	0.0869		89
2SlotThreshold	7.0000		7168
2SlotCoefficient	0.5596	30.5	573
3SlotThreshold	7.0000		7168
3SlotCoefficient	0.5596	30.5	573
4SlotThreshold	7.0000		7168
4SlotCoefficient	0.5596	30.5	573

6. Set the spectrum analyzer for power level tuning:

Frequency	Channel frequency: • **836.6 MHz GSM850** • **897.4MHz GSM900** • **1747.8MHz GSM1800** • **1880MHz GSM1900**
Span	0 Hz
Sweep time	2ms
Trigger	Video triggering (-10dBm)

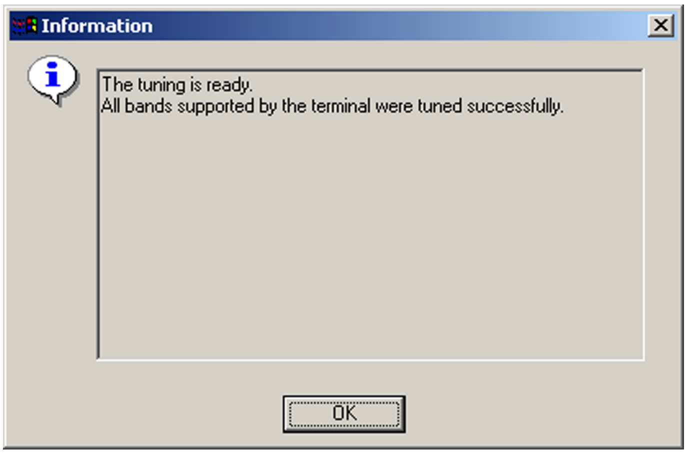
Resolution BW	3MHz
Video BW	3MHz
Reference level offset	sum cable attenuation with module jig attenuation
Reference level	33dBm

A power meter with a peak power detector can be also used. Remember to take the attenuations into account.

7. Adjust power for all bold power levels to correspond the **Target dBm** column by pressing **+** or **–** keys.
8. If all bold power levels are adjusted, click **Next** to continue with **GSM850 EDGE**.
9. Adjust power for all bold power levels to correspond the **Target dBm** column by pressing **+** or **–** keys.

Next actions

Continue tuning the bold power levels of the GSM900, GSM1800 and GSM1900 bands. You will see this message, if finished successfully:



The tuning is ready.
All bands supported by the terminal were tuned successfully.

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5 — System module

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Figure 33 Audio block diagram 5–18
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Figure 35 Vibra circuitry 5–20
Figure 36 USB interface to engine 5–20

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Phone description

Introduction

This chapter describes the baseband module including engine, power management, interfaces, audio etc.

The baseband is based on BB5.0 with a RAPGSM main processor and Retu/Tahvo energy management. All blocks that require high voltage process are in Tahvo and all other in Retu. The RF part is based on the ASIC Ahne.

RM-164 is a quadband phone operating on the GSM850/900/1800/1900 bands.

The phone is a slide phone, with one main part and one top flexible PWB.

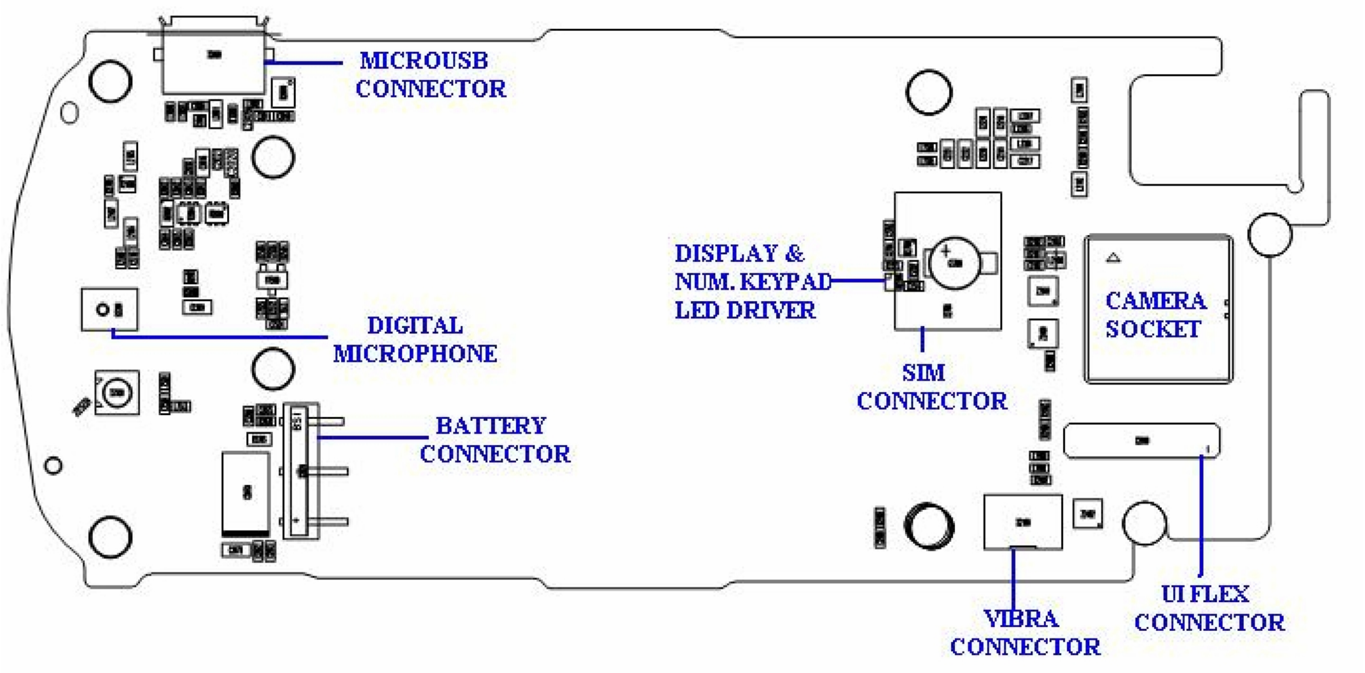
Main board includes: BB and RF blocks, Bluetooth, etc.

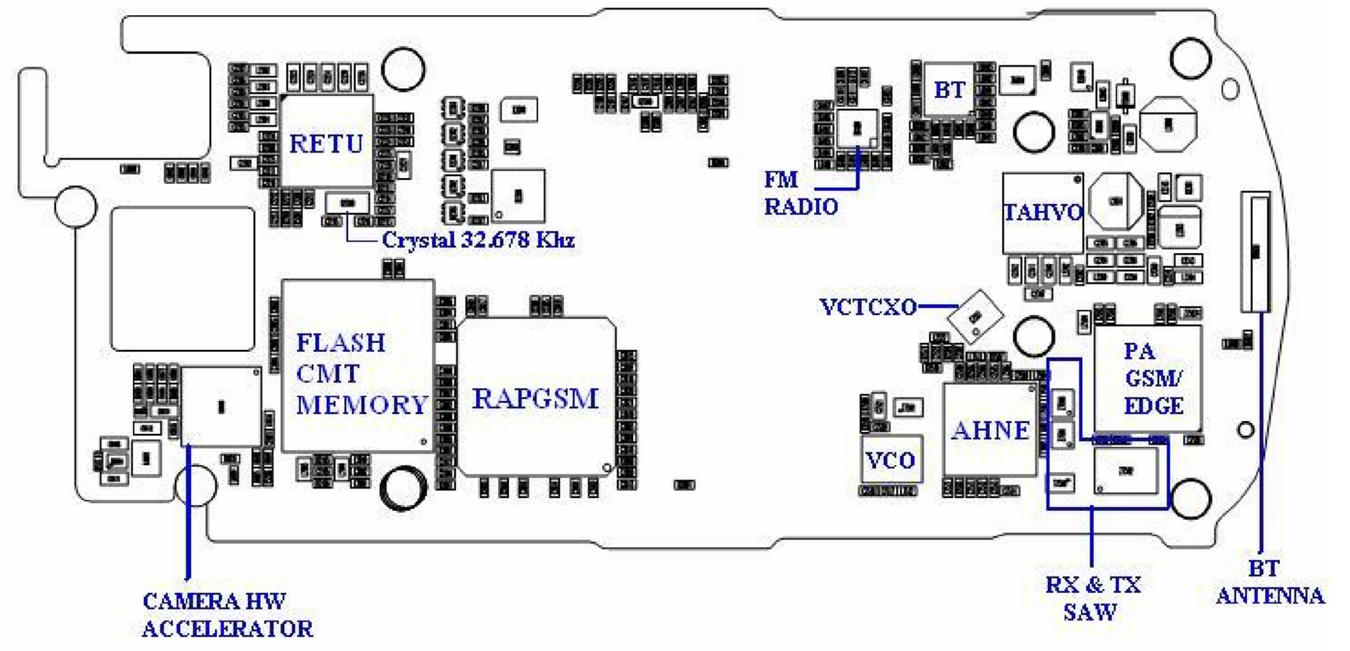
Flexible PWB includes: LCD display, keyboard and earpiece

Characteristic components

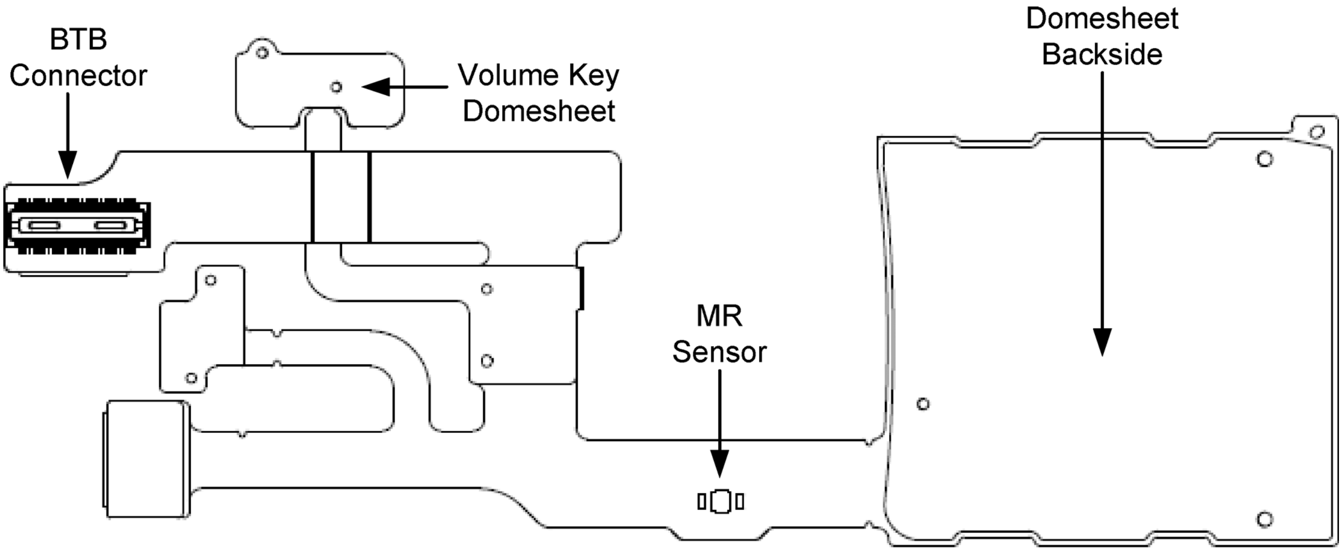
Function	Name	Item
RF ASIC	Ahne	N7505
Energy management	Retu Tahvo	D2200 N2300
Main processor	RAPGSM	D2800
Memory	Combo: 256 Mbit SDRAM, 256 Mbit NOR, 1Gb NAND flash	D3000
Front end module	Power amplifier and Antenna Switch	N7520
Antenna	Antenna module assy (in acoustic chamber)	I226
System connector	Micro USB	X2000
Battery	BP-5M, 3.7 V, 900mAh, Li-Polymer	
Fold detection	1 MR sensor and 1 permanent magnet (IHF speaker)	Sensor: N2400 (flexible PWB)
Bluetooth	BC4-ROM	N6000
FM radio	TEA57601, single chip	N6000
IHF Speaker	In acoustic chamber	B2101
Earpiece	7/11	B2101
Microphone		B2201
Vibra	VIBRA MOTOR	M2100
Charger connector	Micro USB	X2000
Camera	2 Mpix SMIA85, no flash light	X6600
LED driver		N2301
RTC		G3300

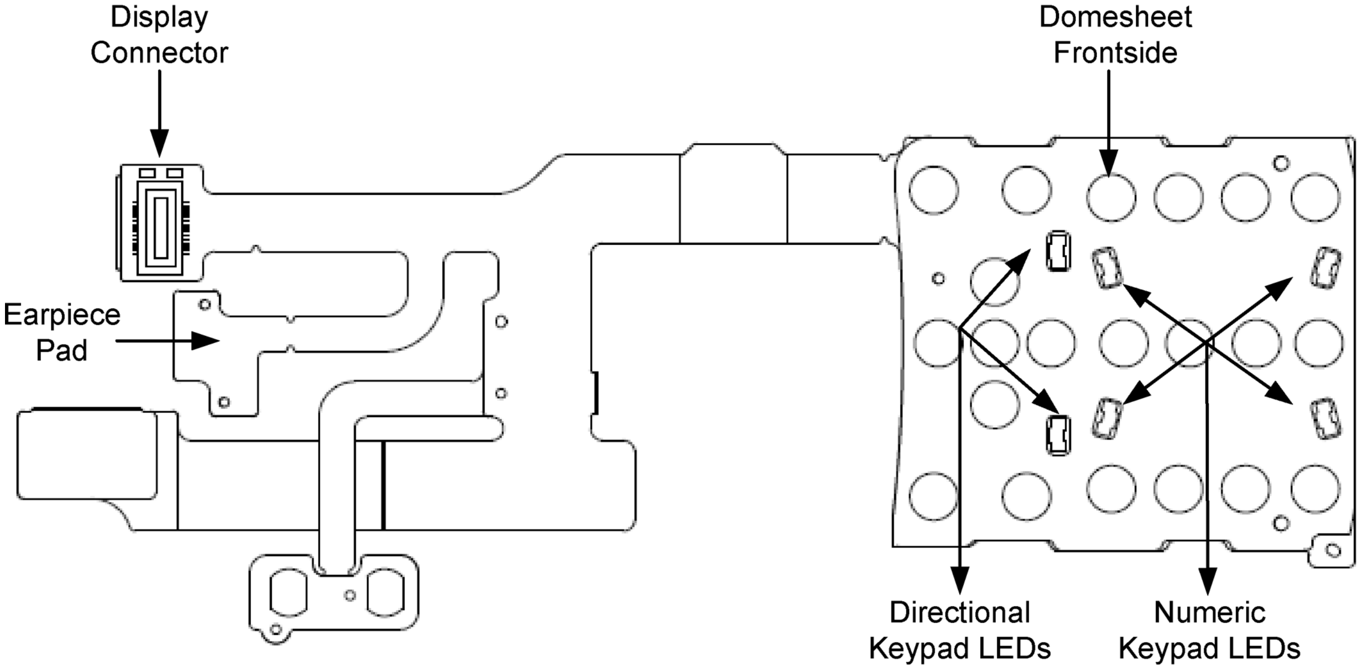
PWB overview


MICROUSB CONNECTOR
DISPLAY & NUM. KEYPAD LED DRIVER
CAMERA SOCKET
DIGITAL MICROPHONE
SIM CONNECTOR
BATTERY CONNECTOR
UI FLEX CONNECTOR
VIBRA CONNECTOR

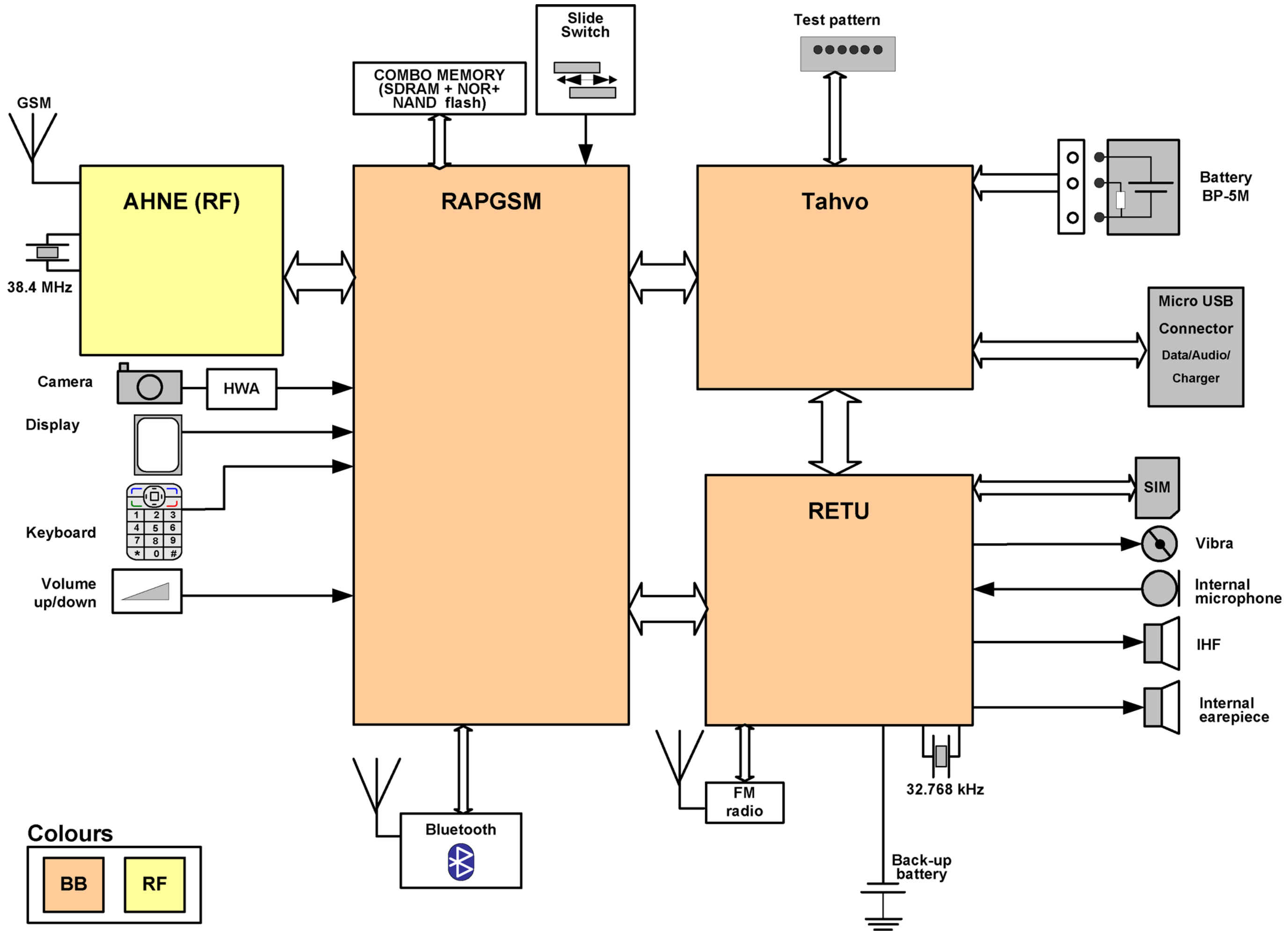

RETU
BT
FM RADIO
TAHVO
Crystal 32.678 Khz
VCTCXO
FLASH CMT MEMORY
RAPGSM
PA GSM/ EDGE
AHNE
VCO
CAMERA HW ACCELERATOR
RX & TX SAW
BT ANTENNA

Flex overview

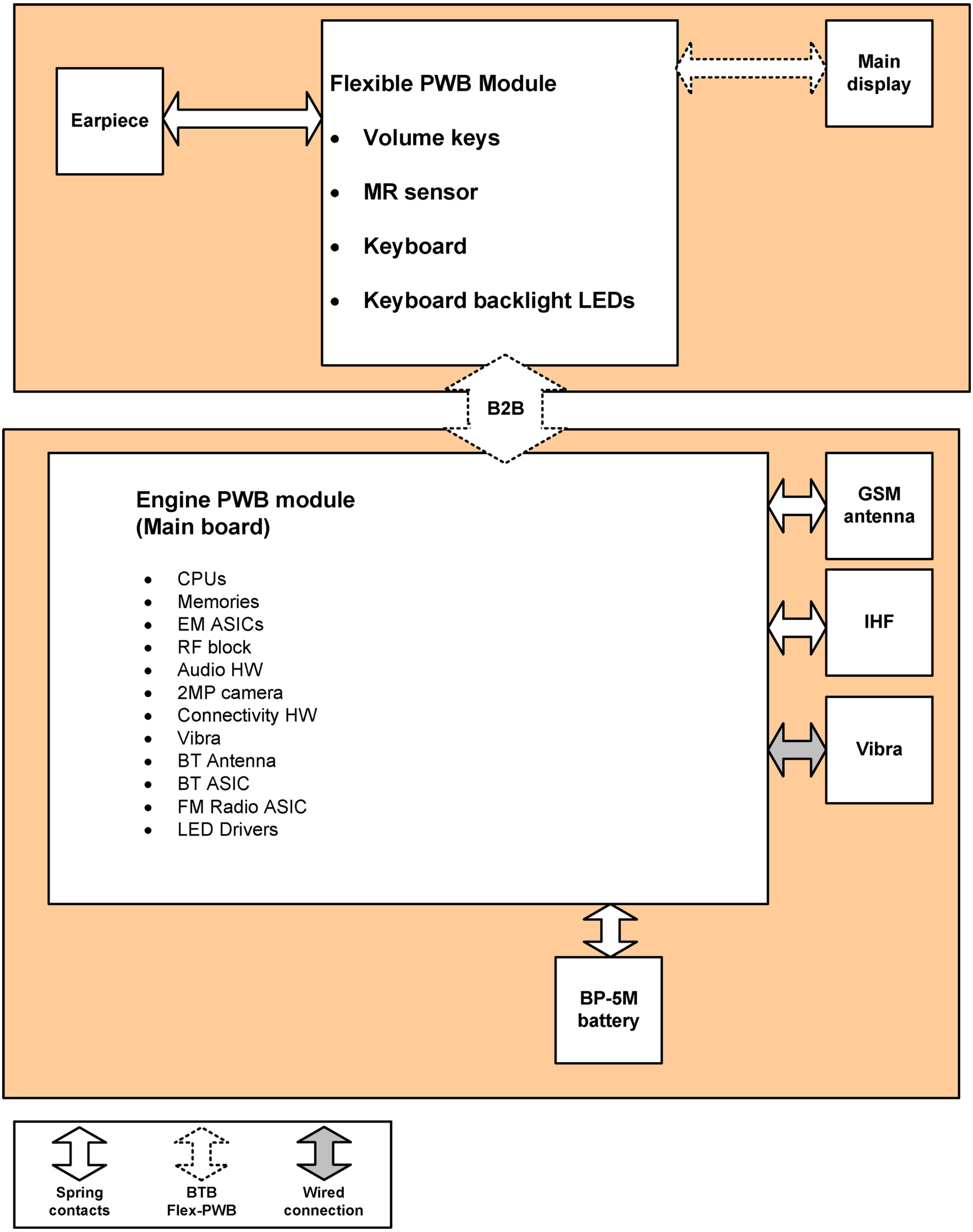

BTB
Connector
Volume Key
Domesheet
Domesheet
Backside
MR
Sensor


Display
Connector
Domesheet
Frontside
Earpiece
Pad
Directional
Keypad LEDs
Numeric
Keypad LEDs

System block diagram


Slide
Switch
Test pattern
COMBO MEMORY
(SDRAM + NOR+
NAND flash)
GSM
AHNE (RF)
RAPGSM
Tahvo
Battery
BP-5M
38.4 MHz
Micro USB
Connector
Data/Audio/
Charger
Camera
HWA
Display
SIM
RETU
Keyboard
1 2 3
4 5 6
7 8 9
* 0 #
Vibra
Volume
up/down
Internal
microphone
IHF
Internal
earepiece
32.768 kHz
FM
radio
Colours
BB
RF
Bluetooth
Back-up
battery

Board and module connections


Earpiece
Flexible PWB Module
Volume keys
MR sensor
Keyboard
Keyboard backlight LEDs
Main display
B2B
Engine PWB module (Main board)
CPUs
Memories
EM ASICs
RF block
Audio HW
2MP camera
Connectivity HW
Vibra
BT Antenna
BT ASIC
FM Radio ASIC
LED Drivers
GSM antenna
IHF
Vibra
BP-5M battery
Spring contacts
BTB Flex-PWB
Wired connection

Engine

Engine modules

The engine contains

- RF module with Ahne ASIC
- Main processor with integrated memory (Baseband)
- Energy management - Retu and Tahvo (Baseband)
- SDRAM, NOR and NAND flash memories

RF engine

The RF module performs the high frequency operations of the engine for GSM. In both transmitter and receiver, the modulator and demodulator operate at the channel frequency.

The core components of the RF module are:

- Ahne RF ASIC (application specific integrated circuit)
- Front end module (FEM) module (Power amplifier and Antenna switch)

The RF engine also includes:

- Voltage controlled oscillators (VCO and VCTCXO)
- SAW filters

The baseband section controls the RF module through the serial bus, RFBus. This passes information about eg. frequency band and mode of operation. Ahne RF ASIC controls the mode of operation, and further sends control signals to the front end module.

In addition to the RFBus there are other interface signals for the power control loop, VCTCXO control and for the modulated waveforms.

Main processor

The main processor in this device is RAPGSM, a BB5.0 ASIC.

Some of its interfaces, processors and controllers are:

- General purpose UARTs
- Processor modules
- I2C (between ICs) interface
- GSM coder
- Interfaces to user interface, SIM and MMC
- Accessory interface
- Handling of RF-BB interface
- I/O voltage = 1.8 V, Core voltage <1.8 V

Energy management

Two ASICs manages the energy in the phone; Retu and Tahvo. Together they cover the analogue audio and energy management function needs.

Tahvo

All blocks that need a special silicon process are included in Tahvo.

Tahvos main features are:

- Energy management control
- Supply voltage generation
- Charge control
- Digital core supply
- Current control for LED supply

Retu

The blocks that do not have special needs are included in Retu.

Retu controls for example:

- Audio block
- SIM
- FM radio

Modes of operation

The functional behavior can be divided into seven different states. Each of these states will affect the general functionality of the phone:

- No supply
- Backup
- Power off
- Reset
- Power on
- Deep sleep

Battery and charging

Battery

- Type: BP-5M, Li-Polymer
- Capacity: 900 mAh
- BSI resistor nominal value: 75 kΩ

Battery temperature is measured on the NTC on the main board.

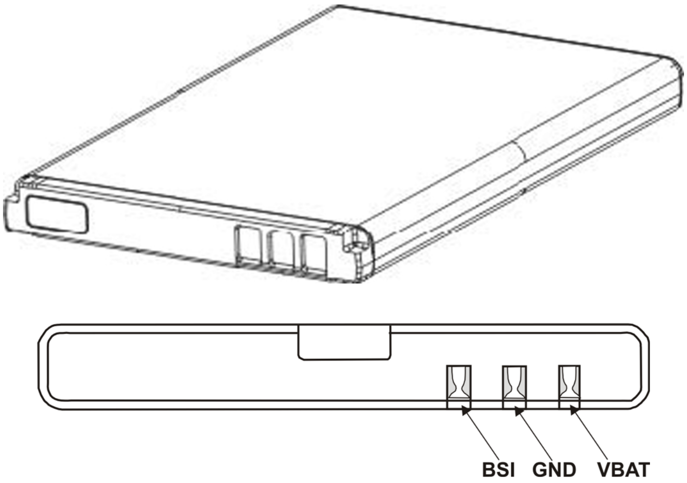


Figure 25 Battery BP-5M

Battery connector

The battery connector has three poles:

- BSI (Battery size indicator)
- GND (Ground)
- VBAT (Battery voltage)

The BSI line is used to recognize the battery capacity by a battery internal pull down resistor.

Charging

This phone is charged through the micro USB connector.

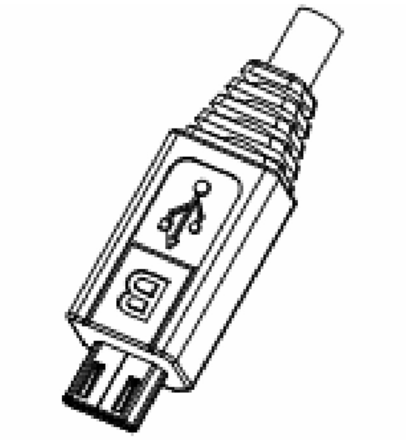


Figure 26 Micro USB charger plug

Charging is controlled by energy management, and external components are needed to protect the baseband module against EMC, reverse polarity and transient frequency deviation.

Test interface

The test interface is placed on the main board, accessible when the battery is removed from the phone. The interface can be used for service and test purposes.

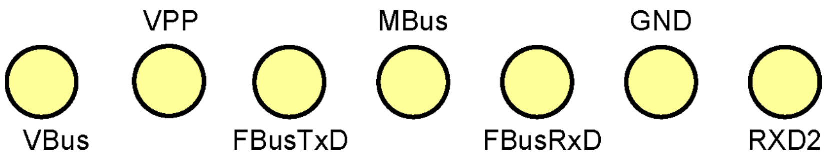


Figure 27 Test interface

Interfaces

Micro USB system connector

The Micro USBconnector is an interface between the phone and the accessories. The configuration may vary between different phone models. In this model it includes:

- Audio
- USB
- Charging

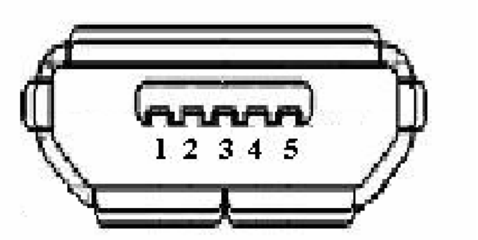


Figure 28 Micro USB connector pins

Table 16 Micro USB connector pins and signals

Pin #	Signal	Pin #	Signal
1	USB VBUs	4	XMIC/FM Antenna
2	USB D-/FBus_TX/XEARL	5	Charge GND
3	USB D+/FBus_RX/XEARR		

FM radio

This phone uses a single-chip electronically tuned FM stereo radio with low voltage application.

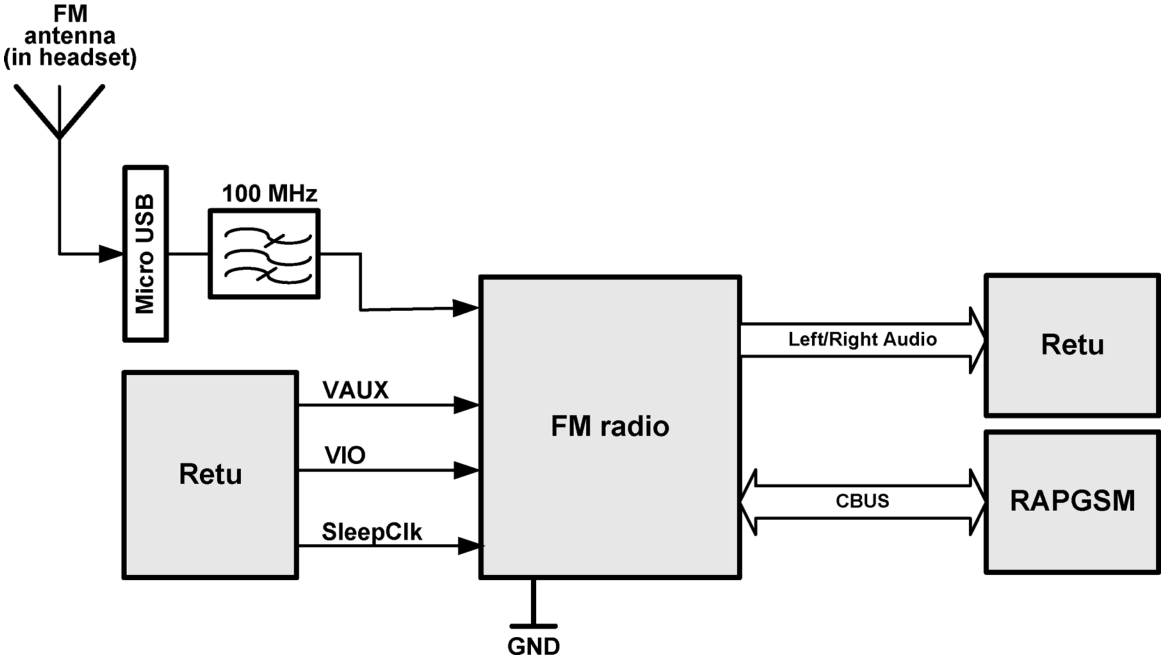

FM
antenna
(in headset)
Micro USB
100 MHz
FM radio
Left/Right Audio
Retu
VAUX
VIO
SleepClk
Retu
CBUS
RAPGSM
GND

Figure 29 FM radio interface

Camera

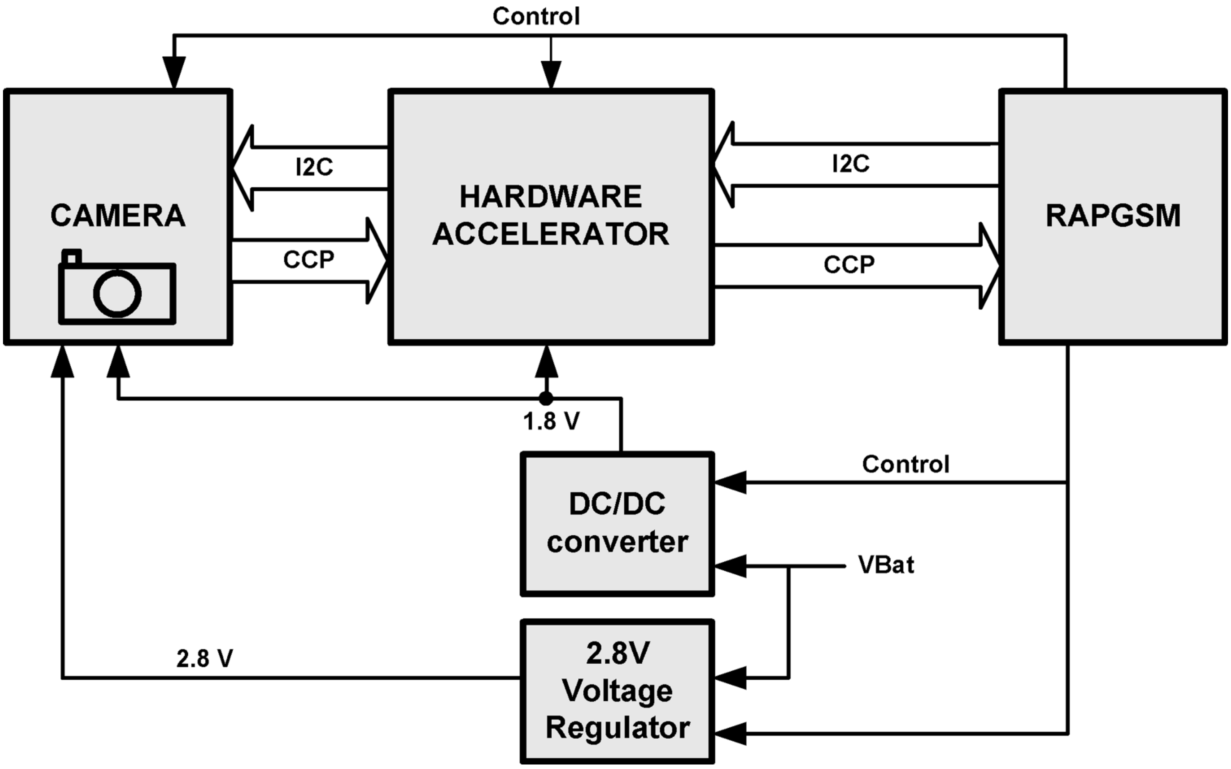

Control
CAMERA
I2C
CCP
HARDWARE ACCELERATOR
I2C
CCP
RAPGSM
1.8 V
DC/DC converter
Control
VBat
2.8 V
2.8V Voltage Regulator

Figure 30 Camera interface

This phone is equipped with a 2 megapixel camera. The module has only one operating mode; raw pixel data output.

A hardware accelerator includes features like pixel defect correction, colour interpolation, image sharpness enhancement, selective noise filtering, cropping and scaling. The image can be JPEG-compressed in real-time. The hardware accelerator also performs sensor housekeeping functions such as automatic exposure and white balance controls.

SIM

The SIM interface is the electrical interface between the SIM card and the mobile phone engine.

The data communication between the SIM card and the phone is asynchronous half duplex.

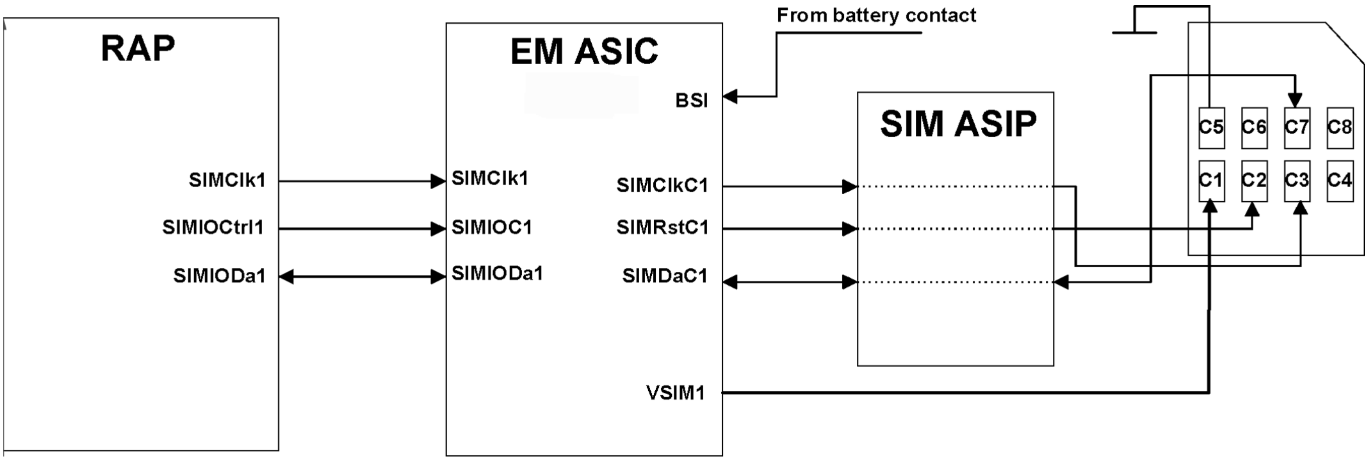

RAP
SIMClk1
SIMIOCtrl1
SIMIODa1
EM ASIC
BSI
SIMClk1
SIMIOC1
SIMIODa1
SIMClkC1
SIMRstC1
SIMDaC1
VSIM1
From battery contact
SIM ASIP
C5
C6
C7
C8
C1
C2
C3
C4

Figure 31 SIM interface connections

SIM Logic level shifting

The SIM interface can support 3V and 1.8V SIM cards.

SIM Power up/down

The SIM power up/down sequence is generated in Retu. This means that Retu generates the reset switch (RST) signal to the SIM. In addition, the SIMCardDet signal is connected to Retu.

The SIM interface is powered up when the SIMCardDet signal indicates “card in”.

User interface

User interface

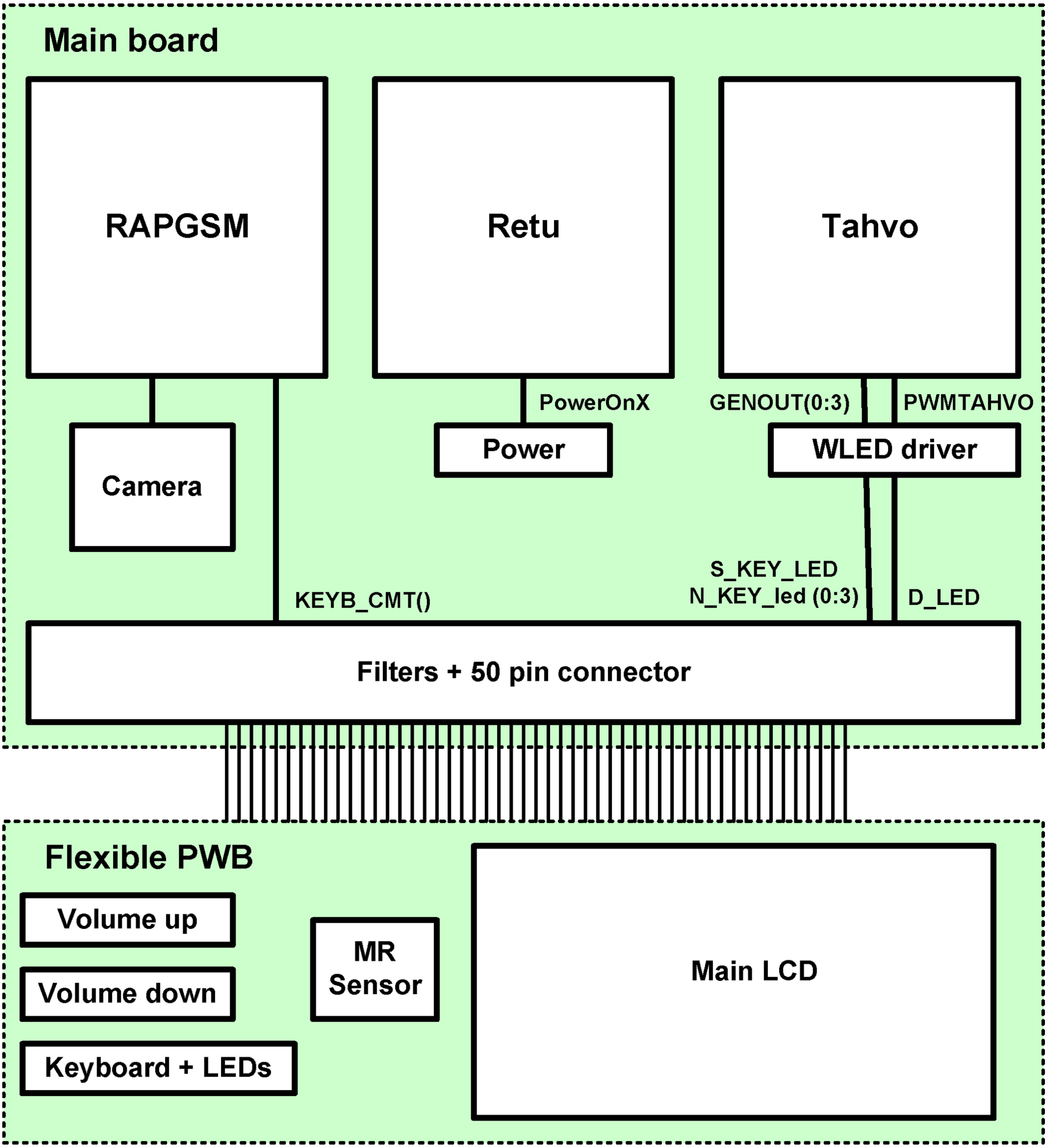

Main board
RAPGSM
Retu
Tahvo
Camera
PowerOnX
Power
GENOUT(0:3)
PWMTAHVO
WLED driver
S_KEY_LED
N_KEY_led (0:3)
KEYB_CMT()
D_LED
Filters + 50 pin connector
Flexible PWB
Volume up
Volume down
MR Sensor
Keyboard + LEDs
Main LCD

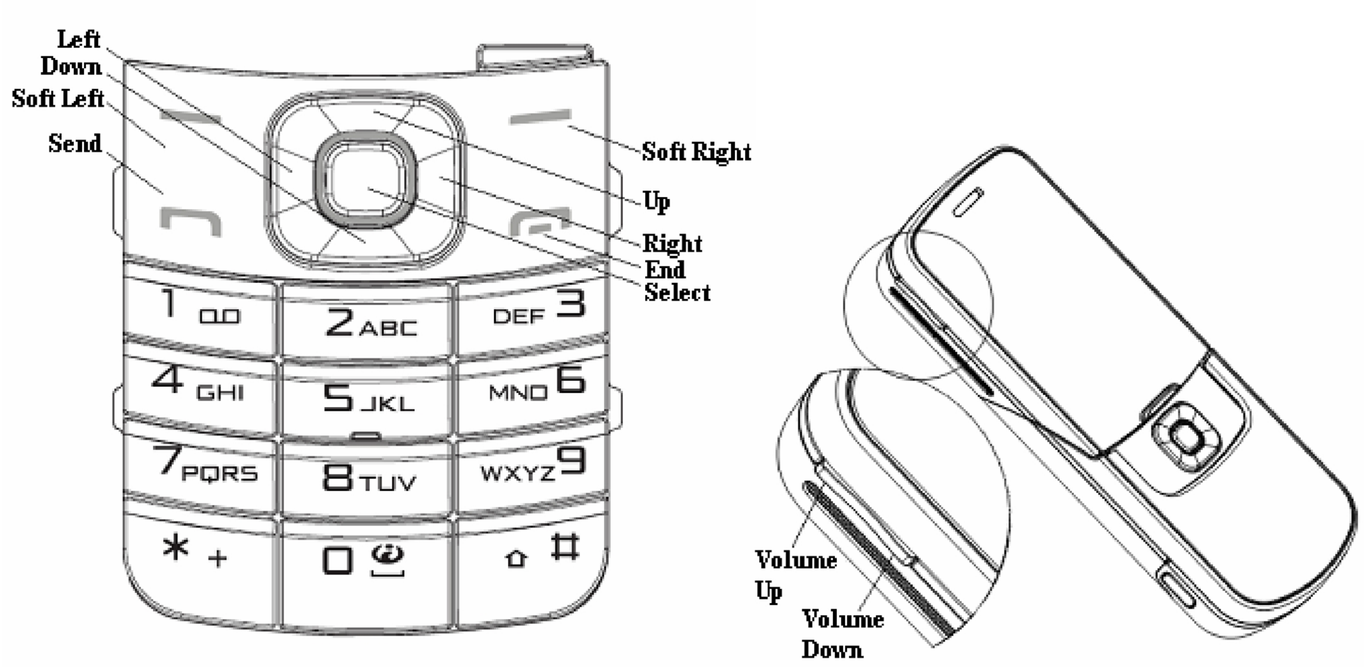
Figure 32 User interface block diagram

Display and display backlight

The main display includes four white LEDs for display backlights inside of the display module. Display backlight current is monitored using LED driver feedback input.

Keyboard and keyboard backlight

Numeric keys, power and volume up/down keys are placed on the flexible PWB.



GENIO		38	42	39	40	41	GND
		COL0	COL1	COL2	COL3	COL4	
32	ROW0		Up	Select	Left	Right	
33	ROW1		Soft Left	Send	Down	Soft Right	
34	ROW2	Volume Up	1	4	7	*	
35	ROW3	Volume Down	2	5	8	0	
36	ROW4		3	6	9	#	
PWRONX							END

There are six white LEDs placed on the keyboard PWB for illumination of the keyboard. Supply source for the display and directional key backlights is implemented using an external white LED driver. The driver increases battery voltage up to 13V. The numeric keypad LEDs are powered by a separate current source LED driver.

Slide switch

The detection of the position of the slide is made through a MR sensor and a magnet. The magnet is internal to the IHF speaker.

When the slide fold is opened, the applied magnetic field is high. This is sensed by the MR Sensor.

Audio concept

Audio hardware architecture

The functional core of the audio hardware is built around two ASICs: RAPGSM engine ASIC and the mixed-signal ASIC Retu.

Retu provides an interface for the transducers and the accessory connector.

There are four audio transducers:

- Dynamic earpiece
- Dynamic speaker
- Microphone module

In addition to the audio transducers, Retu also provides an output for the dynamic vibra component.

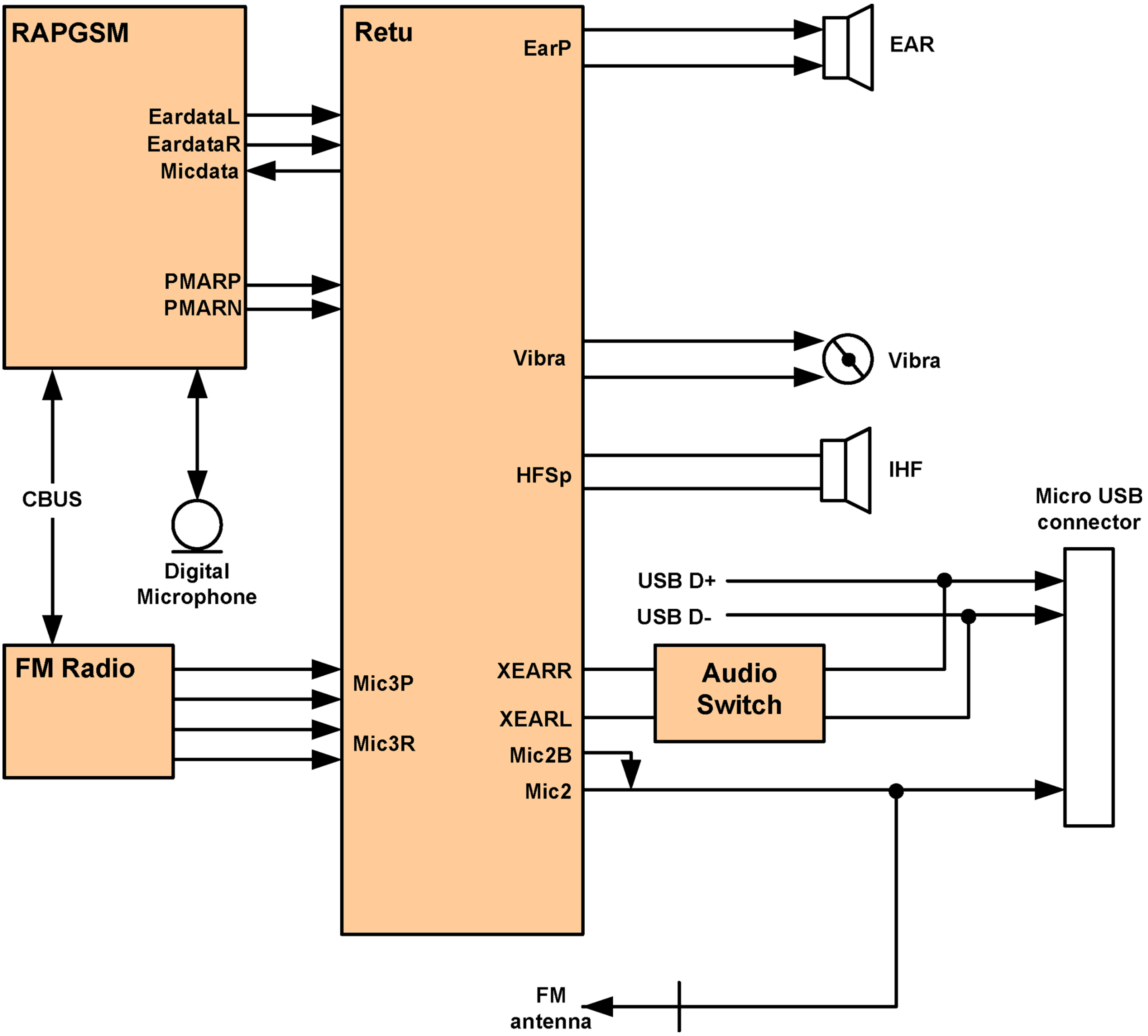

RAPGSM
EardataL
EardataR
Micdata
PMARP
PMARN
Retu
EarP
EAR
Vibra
Vibra
HFSp
IHF
Micro USB connector
CBUS
Digital Microphone
USB D+
USB D-
FM Radio
Mic3P
Mic3R
XEARR
XEARL
Mic2B
Mic2
Audio Switch
FM antenna

Figure 33 Audio block diagram

Internal microphone

Internal microphone is used for HandPortable (HP) and Internal HandsFree (IHF) call modes.

A digital microphone is connected to the RAPGSM’s (D2800) input GENIO71.

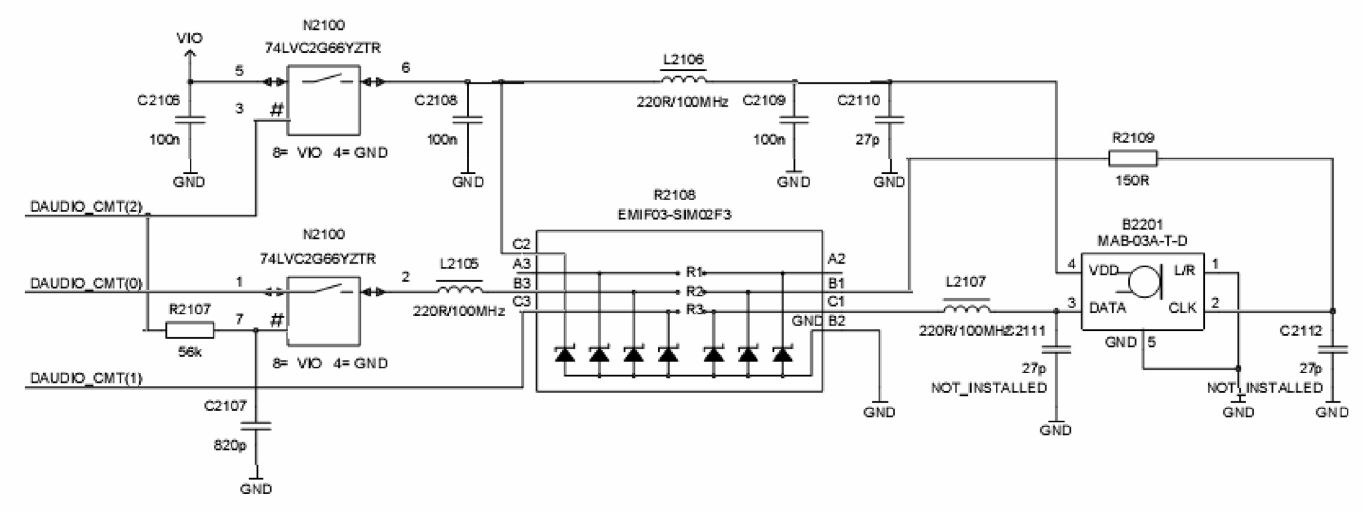

VIO
N2100
74LVC2G66YZTR
5
3
6
C2106
100n
GND
8= VIO 4= GND
C2108
100n
GND
L2106
220R/100MHz
C2109
100n
GND
C2110
27p
GND
R2109
150R
DAUDIO_CMT(2)
R2108
EMIF03-SIM02F3
N2100
74LVC2G66YZTR
L2105
220R/100MHz
DAUDIO_CMT(0)
1
2
R2107
7
56k
8= VIO 4= GND
C2
A3
B3
C3
R1
R2
R3
A2
B1
C1
GND B2
L2107
220R/100MHz
C2111
27p
NOT_INSTALLED
GND
GND
B2201
MAB-03A-T-D
4
VDD
L/R
1
3
DATA
CLK
2
GND
5
C2112
27p
NOT_INSTALLED
GND
GND
DAUDIO_CMT(1)
C2107
820p
GND

Figure 34 Digital internal microphone circuitry

External microphone

Galvanic accessories are connected to the system connector (Micro USB).

Accessory audio mode is automatically enabled/disabled during connection/disconnection of dedicated phone accessories.

Internal earpiece

Internal earpiece is used for the HandPortable (HP) call mode. A dynamic earpiece capsule is connected to Retu's differential output EarP and EarN.

Internal speaker (IHF)

The internal speaker is used for Internal handsfree (IHF) call mode, ringing tones, and listening to music files.

External earpiece

All galvanic accessories are connected to the system connector (Micro USB).

The accessory audio mode is automatically enabled/disabled during connection/disconnection of dedicated phone accessories.

Vibra circuitry

Vibra is used for vibra-alarm function.

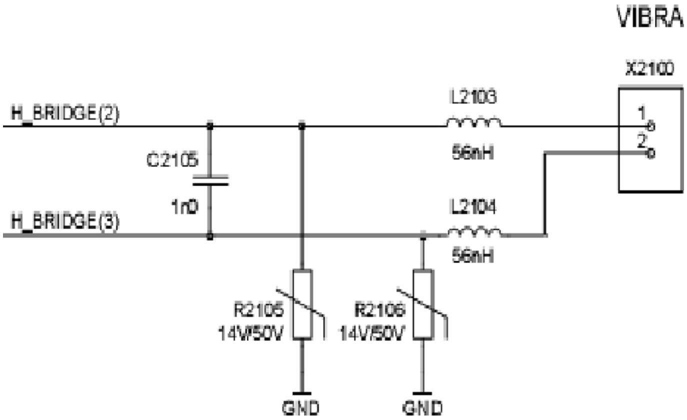

VIBRA
X2100
1
2
L2103
56nH
L2104
56nH
H_BRIDGE(2)
H_BRIDGE(3)
C2105
1n0
R2105
14V/50V
R2106
14V/50V
GND
GND

Figure 35 Vibra circuitry

Connections

USB interface

USB (Universal serial bus) provides a wired connectivity between host PC and peripheral devices.

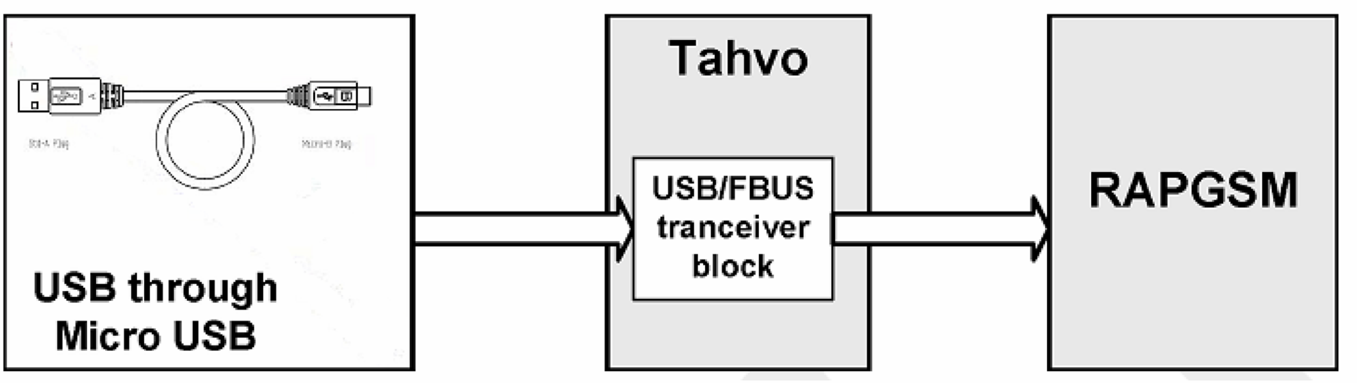

USB through
Micro USB
Tahvo
USB/FBUS
tranceiver
block
RAPGSM

Figure 36 USB interface to engine

The Nokia USB device solution is supported using the Wireless 2 Function Controller (W2FC) core. This core is included in the RAPGSM. The core completes several USB functions automatically and is controlled by the MCU.

The USB solution is also compatible with USB 2.0, with a full speed of 12 Mbps.

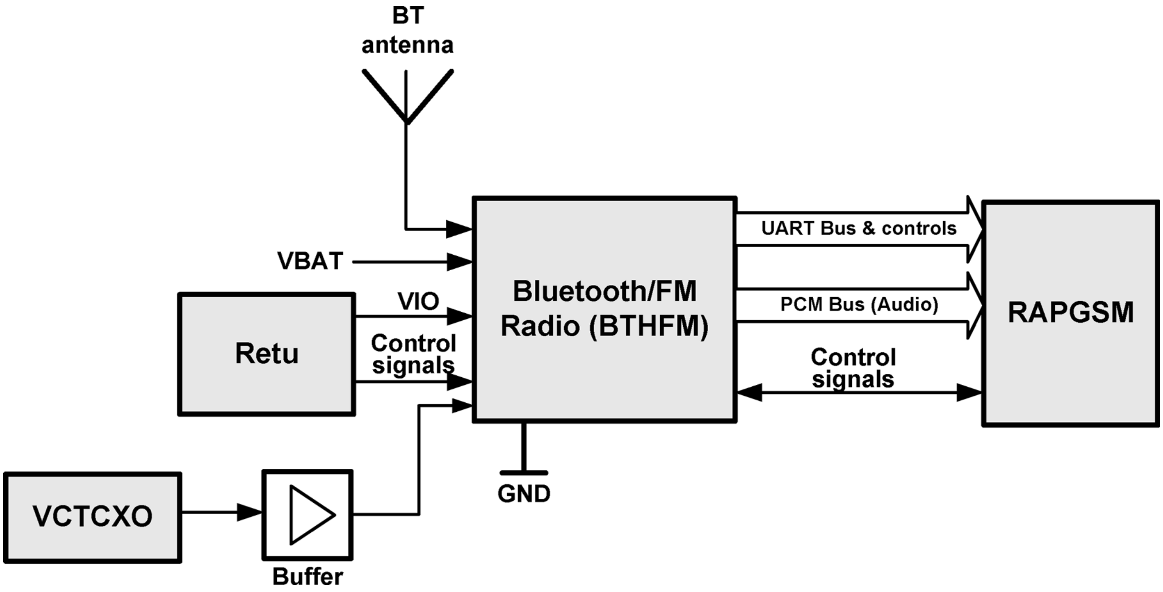
Bluetooth

Bluetooth provides a fully digital link for communication between a master unit and one or more slave units.

This bluetooth solution is a single chip solution.

Bluetooth connects to RAPGSM on the GENIO bus.

The Bluetooth module is provided with power from VBat.


BT antenna
VBAT
Retu
VIO
Control signals
Bluetooth/FM Radio (BTHFM)
UART Bus & controls
PCM Bus (Audio)
Control signals
RAPGSM
GND
VCTCXO
Buffer

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Glossary

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A/D-converter	Analog-to-digital converter
ACI	Accessory Control Interface
ADC	Analog-to-digital converter
ADSP	Application DPS (expected to run high level tasks)
AGC	Automatic gain control (maintains volume)
ALS	Ambient light sensor
AMSL	After Market Service Leader
ARM	Advanced RISC Machines
ARPU	Average revenue per user (per month or per year)
ASIC	Application Specific Integrated Circuit
ASIP	Application Specific Interface Protector
B2B	Board to board, connector between PWB and UI board
BB	Baseband
BC02	Bluetooth module made by CSR
BIQUAD	Bi-quadratic ,type of filter function)
BSI	Battery Size Indicator
BT	Bluetooth
CBus	MCU controlled serial bus connected to UPP_WD2,UEME and Zocus
CCP	Compact Camera Port
CDSP	Cellular DSP (expected to run at low levels)
CLDC	Connected limited device configuration
CMOS	Complimentary metal-oxide semiconductor circuit (low power consumption)
COF	Chip on Foil
COG	Chip on Glass
CPU	Central Processing Unit
CSR	cambridge silicon radio
CSTN	Color Super Twisted Nematic
CTSI	Clock Timing Sleep and interrupt block of Tiku
CW	Continuous wave
D/A-converter	Digital-to-analouge converter
DAC	Digital-to-analouge converter
DBI	Digital Battery Interface
DBus	DSP controlled serial bus connected between UPP_WD2 and Helgo
DCT-4	Digital Core Technology
DMA	Direct memory access
DP	Data Package

DPLL	Digital Phase Locked Loop
DSP	Digital Signal Processor
DtoS	Differential to Single ended
EDGE	Enhanced data rates for global/GSM evaluation
EGSM	Extended GSM
EM	Energy management
EMC	Electromagnetic compability
EMI	Electromagnetic interference
ESD	Electrostatic discharge
FCI	Functional cover interface
FPS	Flash Programming Tool
FR	Full rate
FSTN	Film compensated super twisted nematic
GND	Ground, conductive mass
GPIB	General-purpose interface bus
GPRS	General Packet Radio Service
GSM	Group Special Mobile/Global System for Mobile communication
HF	Hands free
HFCM	Handsfree Common
HS	Handset
HSCSD	High speed circuit switched data (data transmission connection faster than GSM)
HW	Hardware
I/O	Input/Output
IBAT	Battery current
IC	Integrated circuit
ICHAR	Charger current
IF	Interface
IHF	Integrated hands free
IMEI	International Mobile Equipment Identity
IR	Infrared
IrDA	Infrared Data Associasion
ISA	Intelligent software architecture
JPEG/JPG	Joint Photographic Experts Group
LCD	Liquid Crystal Display
LDO	Low Drop Out
LED	Light-emitting diode

LPRF	Low Power Radio Frequency
MCU	Micro Controller Unit (microprocessor)
MCU	Multiport control unit
MIC, mic	Microphone
MIDP	Mobile Information Device Profile
MIN	Mobile identification number
MIPS	Million instructions per second
MMC	Multimedia card
MMS	Multimedia messaging service
NTC	Negative temperature coefficient, temperature sensitive resistor used as a temperature sensor
OMA	Object management architechture
OMAP	Operations, maintenance, and administartion part
Opamp	Operational Amplifier
PA	Power amplifier
PDA	Pocket Data Application
PDA	Personal digital assistant
PDRAM	Program/Data RAM (on chip in Tiku)
Phoenix	Software tool of DCT4.x
PIM	Personal Information Management
PLL	Phase locked loop
PM	(Phone) Permanent memory
PUP	General Purpose IO (PIO), USARTS and Pulse Width Modulators
PURX	Power-up reset
PWB	Printed Wiring Board
PWM	Pulse width modulation
RC-filter	Resistance-Capacitance filter
RF	Radio Frequency
RF PopPort TM	Reduced function PopPortTM interface
RFBUS	Serial control Bus For RF
RSK	Right Soft Key
RS-MMC	Reduced size Multi Media Card
RSSI	Receiving signal strength indicator
RST	Reset Switch
RTC	Real Time Clock (provides date and time)
RX	Radio Receiver

SARAM	Single Access RAM
SAW filter	Surface Acoustic Wave filter
SDRAM	Synchronous Dynamic Random Access Memory
SID	Security ID
SIM	Subscriber Identity Module
SMPS	Switched Mode Power Supply
SNR	Signal-to-noice ratio
SPR	Standard Product requirements
SRAM	Static random access memory
STI	Serial Trace Interface
SW	Software
SWIM	Subscriber/Wallet Identification Module
TCXO	Temperature controlled Oscillator
Tiku	Finnish for Chip, Successor of the UPP
TX	Radio Transmitter
UART	Universal asynchronous receiver/transmitter
UEME	Universal Energy Management chip (Enhanced version)
UEMEK	See UEME
UI	User Interface
UPP	Universal Phone Processor
UPP_WD2	Communicator version of DCT4 system ASIC
USB	Universal Serial Bus
VBAT	Battery voltage
VCHAR	Charger voltage
VCO	Voltage controlled oscillator
VCTCXO	Voltage Controlled Temperature Compensated Crystal Oscillator
VCXO	Voltage Controlled Crystal Oscillator
Vp-p	Peak-to-peak voltage
VSIM	SIM voltage
WAP	Wireless application protocol
WD	Watchdog
XHTML	Extensible hypertext markup language
Zocus	Current sensor, (used to monitor the current flow to and from the battery)